Queensland

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New Minister for Agriculture and Stock

HON. O. O. MADSEN, M.L.A.

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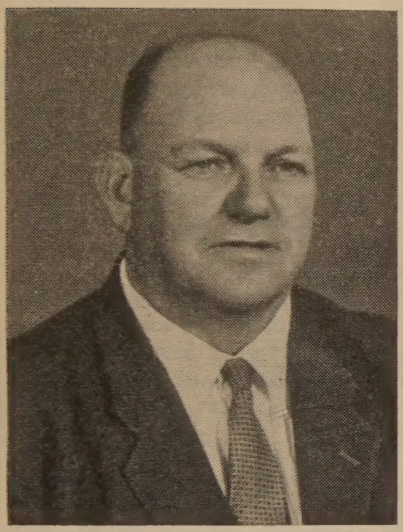


On the change of Government in Queensland in August, the Premier (Hon. G. F. R. Nicklin, M.L.A.) named Mr. O. O. Madsen, Member for Warwick in the Legislative Assembly, as the new Minister for Agriculture and Stock.

Born in Warwick of Danish parents in 1904, Mr. Madsen has lived in the Warwick district all his life. He was educated at the Tannymorel State School and the Warwick State High School, and left his parents' farm at Tannymorel in 1925 to start farming on his own account at Canning Vale. Later he bought a farm at Yangan and has resided there ever since, engaging in dairying and pig-raising.

Mr. Madsen entered Parliament in 1947 as member for the Warwick electorate, which embraces the City of Warwick and over 1,000 square miles of the south-eastern Darling Downs.

He has taken a keen interest in local matters. He was a member of the Glengallan Shire Council, a director of the Killarney Co-operative Dairy Association, and President of the Eastern Downs District Council of the Queensland Dairymen's Organisation. These positions he vacated on his appointment as Minister for Agriculture and Stock.

To enable him to devote his full time to his Ministerial duties, Mr. Madsen has relinquished also positions in the wider sphere of State and Commonwealth agricultural organisation and marketing, some of which he had occupied for many years. The positions he held include State President of the Queensland Dairymen's Organisation,

member of the Queensland Butter Marketing Board, member (and former executive member) of the Council of Agriculture, director of the Queensland Co-operative Cold Stores Federation, Vice-president of the Australian Dairy Farmers' Federation, member of the Commonwealth Dairy Produce Equalisation Committee, member of the Australian Dairy Produce Board, member of the Australian Dairy Industry Council, and member of the National Farmers' Union.

Since his appointment as Minister, Mr. Madsen has been elected Chairman of the Council of Agriculture.

FAREWELL TO Mr. COLLINS.

★

At a staff gathering on the eve of his relinquishing the position of Minister for Agriculture and Stock, which he had occupied for a record term of over 11 years, Mr. H. H. Collins was presented with a silver tray and other gifts on behalf of more than 700 officers in over 80 centres throughout the State.

The Under Secretary (Mr. A. F. Bell) and the Assistant Under Secretary (Technical) (Dr. W. A. T. Summerville) expressed appreciation of the unfailing interest taken by Mr. Collins in the Department and the welfare of its staff, and said that the progress made by the Department during the past decade was due in no small measure to the inspiration and assistance of the retiring Minister.

Mr. Collins has retired from active politics.

Canary Seed Production in Queensland

By S. R. KLOSE, Adviser in Agriculture.

Canary seed is grown as a winter cereal in warm temperate regions. It has assumed some importance in Queensland, mainly on the Darling Downs, as an alternative crop to wheat. It has proved admirably suited to both the soil type and the seasonal conditions of the Downs. As well as being grown for its seed, this crop is of value for grazing purposes.

Canary seed thrives under wet conditions. Good rains in late winter followed by a wet spring are conducive to heavy yields. On the other hand, canary seed once established is also fairly drought resistant.

This cereal, known botanically as *Phalaris canariensis,* is closely related to the well-known pasture grass *Phalaris tuberosa.* Another relative, *Phalaris paradoxa,* has assumed some importance as a weed of cultivation on the Darling Downs. Of this group, however, only canary seed is of importance for grain production.

Canary seed is marketed almost exclusively for bird seed. The chief market is in the United Kingdom. As most other centres of production are in the Northern Hemisphere (for example, Morocco, Spain and Turkey), Australian seed can be landed in the United Kingdom when the market is relatively bare. A potential market for our seed also exists in the U.S.A. and small consignments have already been supplied to that market.

The Argentine also produces canary seed. The chief outlet for this seed at present is the U.S.A.

After a modest start of some 15 acres in 1915, acreage sown to this crop was of little significance until

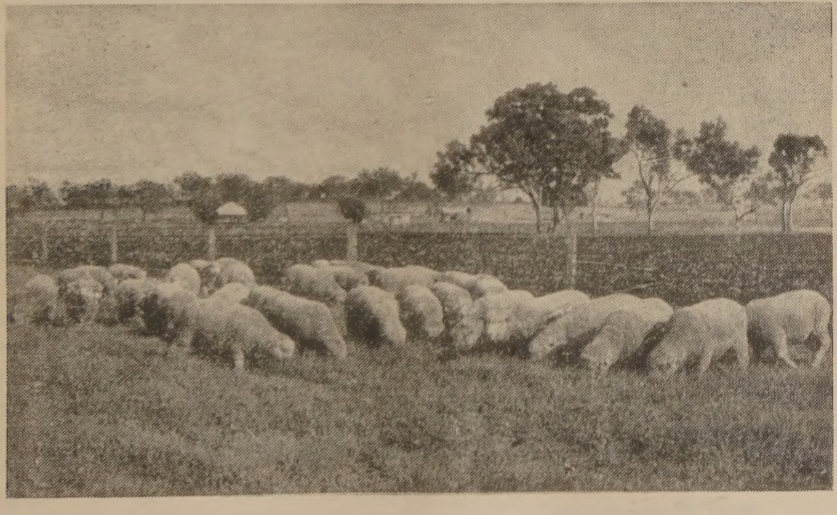


Plate 1.

Sheep Grazing Canary Seed on the Darling Downs.

Photo. by courtesy Queensland Country Life.

Plate 2.

Cattle Grazing Canary Seed on the Darling Downs.

[*Photo. by courtesy Queensland Country Life.*

after World War II. Since then the acreage has expanded rapidly. The price received by growers in recent years has been an important factor in the spectacular increase in acreage. (Table 1).

Up to £110 per ton may be received for this crop. The average price paid to growers prior to 1954 was between £45 and £60 per ton.

TABLE 1.

ACREAGE, PRODUCTION AND VALUE OF CANARY SEED.

Year.	Acreage.	Total Production.	Value.
		(Bushels)	£
1915	15	96	60
1920	12,425	157,536	58,021
1925	3,291	9,257	9,390
1930	3,299	46,253	33,554
1935	9,438	65,190	3,798
1940	2,349	17,014	6,806
1945	16,657	201,710	63,034
1950	11,932	125,961	168,700
1955	73,469	894,633	2,232,346
1956	100,000	1,209,600	2,322,000

Soil Preparation.

Soil preparation is similar to that required for wheat. The land is first prepared with a disc or tined implement, leaving a rough cloddy surface to absorb summer rains. Subsequent working with the harrows, combine or scarifier will control weed growth and provide a firm seedbed 2-3 in. deep.

A summer fallow is essential to conserve as much of the summer rainfall as possible. The subsoil moisture so retained should satisfy the greater part of the moisture requirements of the crop.

Seed Strains.

Queensland seed is said to be smaller than some Spanish and Moroccan strains sold on the United Kingdom market.

Although it has been established that there are large-seeded strains, no information is yet available on their yield performance. Because buyers are reported to favour the larger seeded types, some effort has been directed recently towards selecting large-seeded strains locally and also to introducing them. Some headway has been made in both directions.

Further work along these lines is being undertaken by the Department of Agriculture and Stock. Detailed trials on grain size and yield as well as disease resistance must be undertaken, however, before improved strains can be released for general cultivation.

Sowing.

Canary seed may be planted from March to late June. Early planting is recommended where grazing is required. The seed is sown 2-3 in. deep on a firm moist seedbed, at the rate of 8-10 lb. per acre.

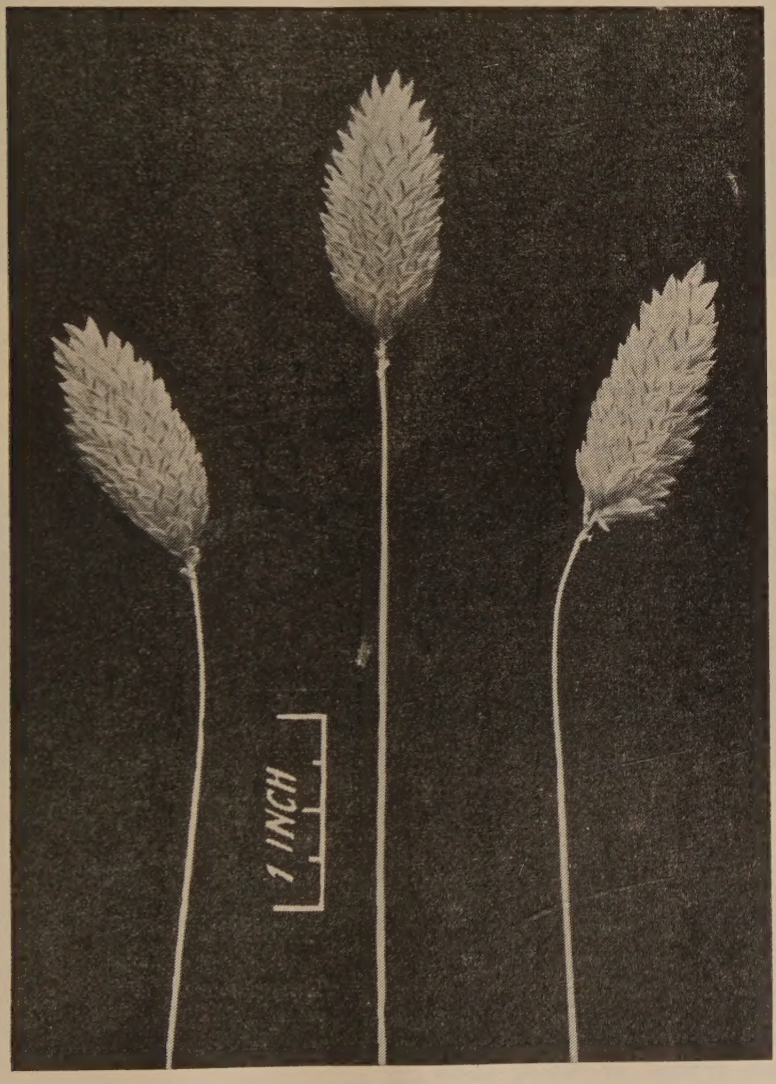


Plate 3.

Typical Heads of the Strain of Canary Seed which has been Grown for Many Years in Queensland.

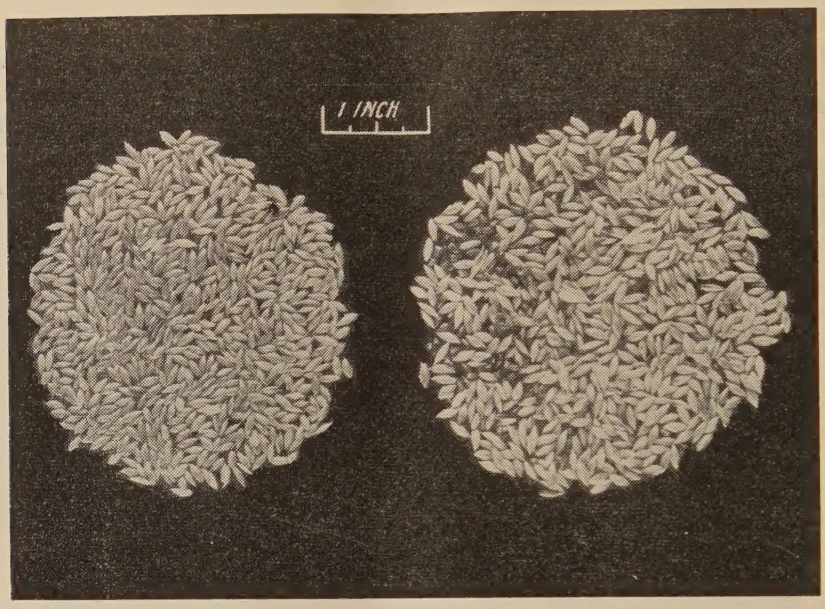


Plate 4.

Seed of the Canary Seed Crop. Left: Well graded sample of seed of the Queensland strain. Right: Poorly graded sample showing a high percentage of dehulled grain as well as grain and chaff of another crop (wheat). Despite its greater seed size the second sample is in an unsuitable condition for export.

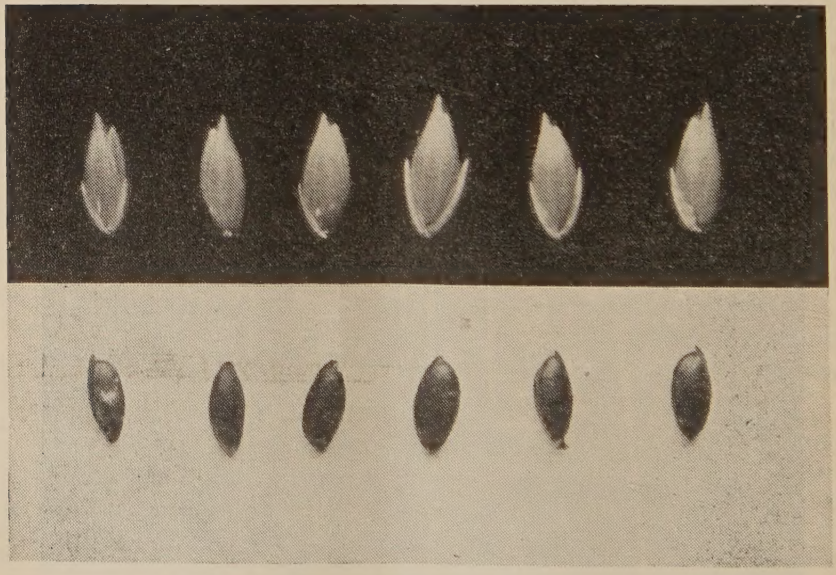


Plate 5.

Individual Seeds of Canary Seed (approx. twice natural size). Top: Whole seed, as required by purchasers. Bottom: Dehulled seed, unwanted in samples for sale.

The standard wheat combine must be modified to sow this crop satisfactorily. The smooth shiny surface of canary seed causes the seed to flow rapidly through the normal combine setting for wheat. Special grain reducer castings are available for most combines to handle small seeds. If these are not available, leather strips attached to the seedbox and thrust into the seed chute will effectively slow down the rate of flow. The thickness and length of the leather will govern the rate of seed flow.

Grazing the Crop.

Canary seed does not produce as vigorous a root system as oats. Thus the crop tends to pull out more readily, particularly when grazed by cattle. To avoid this the stand should be allowed to root firmly before grazing is commenced. Under good growing conditions the crop can be grazed 6-8 weeks after germination. By this time the crop is 6-8 in. high. Grazing can be continued at intervals until September or October.

If it is intended also to harvest the crop for grain, grazing should cease before the seedheads commence to develop in the leaf sheaths. This can be ascertained by closely examining the plants.

Harvesting.

A wheat header is quite suitable for harvesting canary seed. Careful attention, however, must be given to header adjustments to ensure freedom from damaged grain. A proportion of damaged or dehulled seed in the harvested grain lowers its market value.

The main adjustment necessary is to the threshing drum. To ensure a good sample, close attention must be paid to clearance, wind draught and setting of the screens. Special screens to handle small grains such as canary seed are available for most popular makes of harvesting machines.

Under normal conditions an average crop will yield 12-21 bus. per acre. However, yields up to 36 bus. per acre have been recorded in recent years.

Pests and Diseases.

Canary seed is not subject to many important diseases. Fusarium crown rot and powdery mildew may at times affect this crop. To minimise losses from crown rot, growers are advised to rotate their ground to resistant crops such as linseed, legumes and summer crops. As an added precaution the seed should be treated with one of the proprietary mercurial seed dressings.

Cutworms and armyworms can cause a great deal of damage to the growing crop. DDT applied at the rate of ½ lb. active ingredient per acre will control these pests effectively.

Marketing.

Up to the present time buyers have not offered a premium for large seed for export. The present method of determining a price for Australian seed, in competition with seed from other sources, appears to be on seed sample. Until an appreciable quantity of large-sized seed is available for export, overseas buyers can only operate on the average Australian sample.

If Australian grown seed is to obtain an assured and ever-expanding share in overseas markets, steps must be taken to ensure that the product fulfils market requirements. At present the demand is for well graded, plump, bright seed free from both foreign matter and dehulled grain.

It is an established fact that birds prefer to remove the seed from the enclosing husk; hence the emphasis on freedom from dehulled grain in market samples.

VELVET BEANS AS A GRAZING CROP.

Increasing use is being made of velvet beans as a grazing crop in Queensland, says Mr. O. L. Hassell, Senior Adviser in Agriculture, Department of Agriculture and Stock. This trend is most marked in districts where cowpeas are losing favour because of heavy losses from stem rot.

The velvet bean, a summer-growing annual legume, has a growing period of four to six months before the pods start to ripen. Cowpeas usually reach this stage within three months. The longer growing period is probably the reason why velvet beans have not been grown in Queensland to the same extent as cowpeas. However, the long growing period allows the crop to carry well into the cooler months and provide valuable grazing when leguminous crops are usually scarce.

As a grazing crop, velvet beans easily outyield any of the cowpea varieties. Velvet beans will grow reasonably well on most soils, and are capable of producing good yields on land considered too poor to grow cowpeas satisfactorily. The seed should be inoculated before planting with the proper strain of nitrogen-fixing bacteria. The crop is then able to obtain nitrogen from the air. On some soils, fertilizers containing phosphorus and potassium may be necessary. The Mauritius variety is grown most widely in Queensland.

For grazing, velvet beans are usually grown with maize, but the beans are sown about six weeks later than the maize. Two rows of maize 3 ft. apart are alternated with a row of velvet beans. The sowing rate of bean seeds is about 10 lb. to the acre. The long runners of the beans eventually climb to the top of the maize stalks and form a dense mass of feed, all of which the stock will eat. To get the most out of a crop of velvet beans, light and intermittent grazing should be practised.

If allowed to set seed, velvet beans yield about 1,000 to 1,500 lb. of seed an acre. The weight of unthreshed seed in the pod will be about double this. For feeding purposes, the seed need not be threshed. Usually the whole pod is fed after having been soaked in water for 24 hours or crushed into a meal. Seed harvesting is a tedious job as it is normally done by hand.

ACTION ON GIANT SENSITIVE WEED.

The Minister for Agriculture and Stock (Hon. O. O. Madsen) has been advised that the Commonwealth quarantine authorities are taking action to declare the giant sensitive plant (*Mimosa invisa*) a prohibited import.

This step is being taken with the concurrence of all State Departments of Agriculture. It means that any imported seed found to be contaminated with sensitive plant seed will be seized at the port of entry and either cleaned of weed seeds to the satisfaction of an inspector or destroyed.

Mr. Madsen said that these precautions had previously been taken by his Department in respect of seed offered for sale in Queensland. However, seed purchased interstate by landholders was not available for inspection and weed-infested seed had continued to be brought into the State. This loophole would now be blocked.

The Commonwealth was not agreeable to prohibiting the importation of seeds from tropical countries where giant sensitive plant was known to exist, but strict enforcement of the proposed regulations should eliminate further introductions.

Mr. Madsen emphasised that landholders should be on the watch for this very serious pest and take steps to eradicate small outbreaks. Any landholder in doubt as to the identity of the pest should consult the nearest officer of the Department of Agriculture and Stock.

A Layout for Contour Furrow Irrigation of Tobacco on a 5 Per Cent. Slope in the Mareeba-Dimbulah Area.

By J. ROSSER, Soil Conservationist.

Furrow irrigation of tobacco on slopes of 2 per cent. and over presents problems in regard to:—

Even watering.

Economical use of water.

Erosion caused by irrigation water.

Erosion caused by storm water runoff.

This article shows how these problems were met and successfully overcome by Messrs. R. Loccisano and Son at Walkamin on a typical loamy sand tobacco soil of 5 per cent. slope.

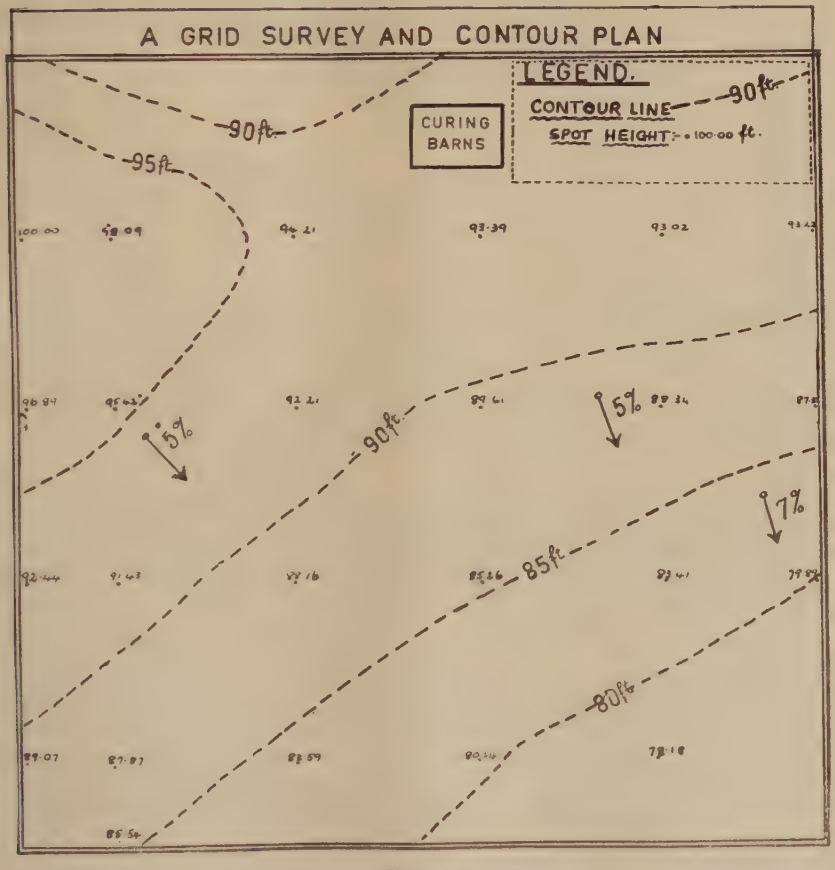


Plate 1.

Initial Contour Plan of R. Loccisano & Son's Irrigation Area. The plan shows details of spot heights and contour lines drawn at a vertical interval of five feet.

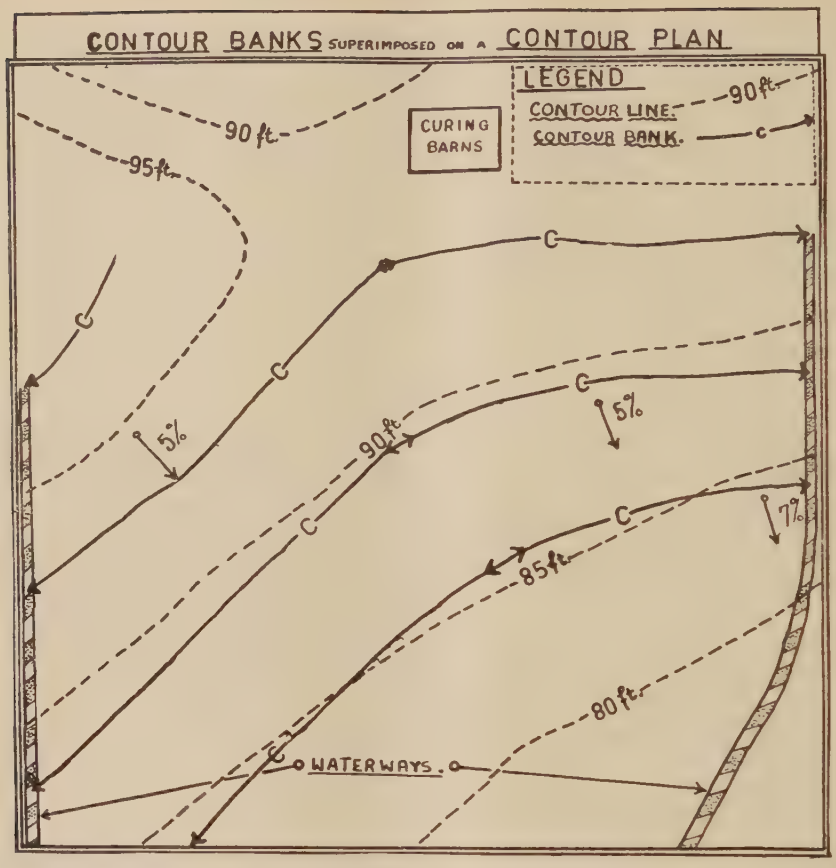


Plate 2.

Contour Banks and Waterways Superimposed on Plate 1. Note the necessary divergence of the banks from the contour lines to give the necessary gradient to allow water to run into the waterways.

The crop was grown and watered by the furrow irrigation method. The principles of this method of irrigation were described as part of an article in this Journal (E. W. Baird, December, 1955).

The best gradient for furrow irrigation is 2 in. to the chain. If the gradient is higher it is necessary to place "stops" along the row. These cause extra work and expense. If the gradient is still higher, water will run too quickly to allow side penetration and this will be reflected in the uneven and stunted growth of the crop. It is highly desirable, therefore, to keep row gradients close to 2 in. to the chain and not above 4 in. to the chain.

To achieve a row gradient within these limits on a slope of say 5 or 6 per cent. and still have a workable layout may not be possible in every case. However, it was done successfully with a high percentage of row gradients within the desired limits on an awkward-shaped piece of ground on Loccisano and Son's property. Their experience may be helpful to others with similar problems.

SOIL TYPE.

The soil was a loamy sand overlying a clay subsoil. The depth of the surface layer was 8-10 in.

LAND PREPARATION.

The ground had been ploughed and brought to a fine tilth ready for planting before it was surveyed. It had not been graded to remove surface irregularities, and some could still be seen after the crop was harvested. (See Plate 6).

It is considered that even better results would be achieved if prior land grading were attended to.

CONTOUR PLAN.

The preparation of a contour plan is usually a worthwhile preliminary step. Contour banks adequate for erosion control could be marked out without the preliminary survey, but when they have the secondary function of irrigation guide lines, careful thought must be given to their location and gradients. Gradients not only of the contour banks but of each row of tobacco must be considered.

A 100 ft. grid survey was made of the area, using a dumpy level and staff. Levels were plotted on squared paper and contour lines drawn in to

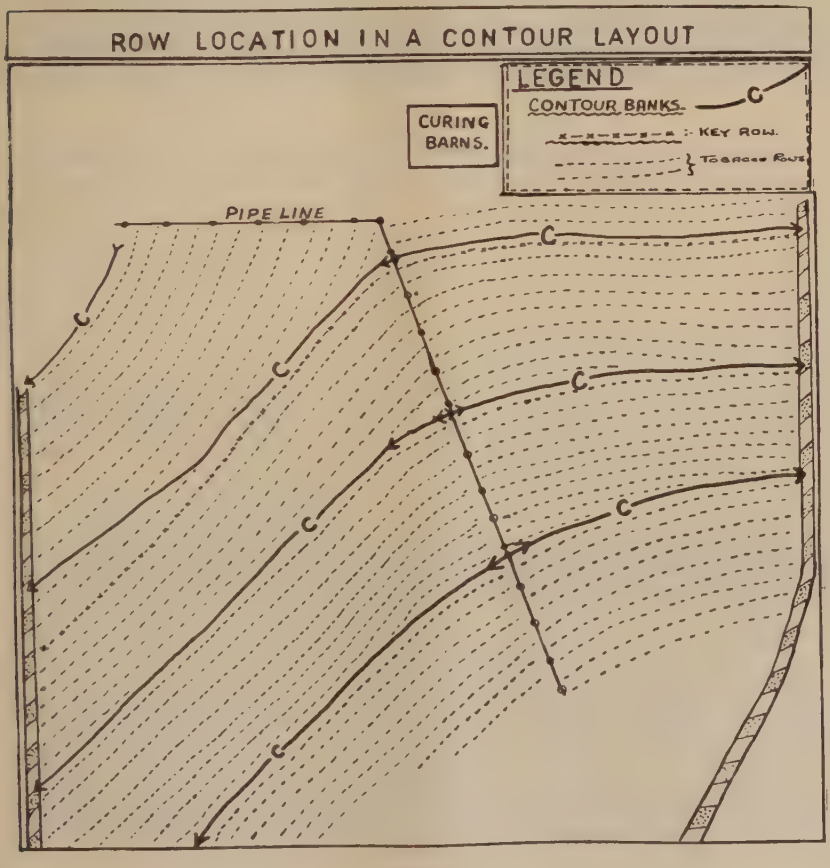


Plate 3.

Row Plan Developed from the Bank Sites shown in Plate 2. In this case the upper contour bank of each bay serves as a guide line except at the left-hand end of the second border from the top. Here the keyline follows the upper, then, due to the divergence of the banks, the lower bank.

Plate 4.

General View of the Area Described. The central position of the pipeline can be clearly seen, while the grassy strips indicate contour banks. (Photographed during harvesting.)

Plate 5.

Middle Contour Bank of the Area on the Right-hand Side of Plate 2. In the foreground the bank can be seen continuing across the uncultivated area to the waterway. (Photographed during harvesting.)

help in planning the final layout (Plate 1). It will be seen that the slope varied up to 7 per cent. in the steepest part. The main slope is diagonally across the field from the top left to the lower right-hand corner of the plan. There is a ridge running along the top of the area on which the curing barns are situated, but this does not materially affect the design.

LAYOUT.

The layout adopted (see Plates 2-4) consisted of a series of contour banks which, in addition to their normal function of controlling excessive runoff water during storms, served as guide lines for planting of tobacco rows.

The crop was grown rather late in the spring and the contour banks were called upon to prevent erosion from storm water at the beginning of the wet season. They did this successfully. They also served as roadways through the crop, but their most important function was as guide lines for the tobacco rows.

From the contour plan (Plate 1) it could be seen that the widest space between contour lines was in the middle section of the block. This, then, was the most suitable location for the pipeline. Siting of the pipeline where contours are widest is an advantage, as it permits watering straight into the short rows as explained later. From the saddle at the top, water could be piped down through the middle of the block. A branch line could also be sent up to the top left-hand corner to command the highest part of the area.

Contour banks could then be run in both directions away from the central pipeline, with a bank in the top left-hand corner to serve this area. Tobacco rows planted parallel to the contour banks would likewise run away from the pipeline, thus permitting irrigation.

Layouts for other areas could be designed on similar lines, modified to suit individual circumstances. A central pipeline is an advantage, as it permits watering in two directions and a large area is commanded without shifting the pipeline.

ROW PLACEMENT.

The placement of rows is shown in Plates 3, 5, 6 and 9. Tobacco rows are planted in this case parallel to the upper contour bank in each bay, except at the left-hand end of the second bay from the top, where it is necessary to switch and run parallel to the bottom contour bank. Short rows run out into the channel of the lower contour bank in each bay, again with the exception of the two short rows at the left-hand end of the second bay. It will be possible to run water directly from the pipeline into all these short rows except the two mentioned.

The principles governing this row placement are explained in Plate 8. It is necessary for watering that all rows fall continuously away from the pipeline. The rules to follow are:—

(1) If two contour banks converge towards their direction of flow, plant rows parallel to the upper contour bank.

(2) If the contour banks diverge towards their direction of flow, plant rows parallel to the lower contour bank.

(3) If the contour banks diverge and then converge towards their direction of flow, the rows must be planted parallel first to the upper contour bank and then to the lower. In this case, a single guide row is marked off, using two men and a piece of string. Parallel the upper bank in sections narrowing towards the outlet and parallel the lower terrace in sections widening towards the outlet.

Plate 6.

Discharge End of a Contour Bank. The few short rows can be seen ending at the contour bank channel. (Photographed during harvesting.)

MARKING OUT CONTOUR BANKS.

The layout having been decided, the contour banks were drawn in on the contour plan (Plate 2). The banks were then marked out in the field using a surveyor's staff and dumpy level. The lines were pegged at 50-ft. intervals.

Simple water tube levels are equally satisfactory for marking out.

DESIGN FEATURES OF CONTOUR BANKS.

Length.

In this case length of the longest banks was 250 ft. in each direction. This was quite satisfactory.

The length that it is possible to water on a given soil type will be the governing factor. On most sands and sandy loam tobacco soils, a length of five chains in each direction would be the desirable maximum.

Spacing.

Spacing used was about 80 ft., widening to 100 ft. in the centre. The spacing was governed by the shape and size of the paddock and the variations in slope. It was necessary to have one bank as far up into the saddle as possible. Had only one bank been used below this, the lower rows of each bay, though parallel to the contour banks, would have had excessive gradients. So two banks were put in, bringing spacing down to 80 ft.

With the short bank length which seems to be desirable to suit irrigation, spacing will be governed by considerations such as this rather than by the possibility of erosion. A spacing of 100 ft. is a good workable size and on a more regular slope would be quite adequate.

Gradient.

All contour banks were surveyed with a gradient of 1½ in. to the chain. On the right-hand side of the field this resulted in row gradients of

about 2 in. per chain and the performance was very satisfactory. On the left-hand side, where banks were nearly parallel, the row gradients were only 1½ in. per chain and some waterlogging occurred. This was also in part attributable to local land irregularity.

Since we recommend a gradient of 2 in. to the chain, it is considered that in future projects contour bank gradient should be 1½ in. per chain where it can be seen from the contour plan that contour banks will not be parallel. In this case the row gradients will be greater than the 1½ in. per chain. On the other hand, if contours, and consequently contour banks, are parallel, the gradient of the bank should be the same as that desired for the rows—that is, 2 in. per chain.

Size.

Contour banks of about 3 sq. ft. capacity (see Plate 6) were built, using a tractor and attached plough. For the short bank length this is quite satisfactory.

Irrigation.

Irrigation was effected from the central pipeline (Plates 4 and 7). A drill up this centre line served as a head ditch. Water was run into short sections of this ditch at a time. This section, the length of an irrigation pipe, was lined with overlapping bags and the water forced into the lateral furrows as required by blocking off with another bag. When the rows on each side of this section were watered, operations were shifted to the next short section. With the bags as protection, no erosion was caused along the centre furrow.

In this way all the long rows and most of the short rows were watered. The two short rows in the left-hand end of the second top bay on the left (Plate 3) presented a greater problem. They were watered from a drill brought along the top long row

Plate 7.

The Central Pipeline, Looking Downhill. Sites of the small head ditches used to water the rows on either side can be seen parallel and very close to the pipe. (Photographed during harvesting.)

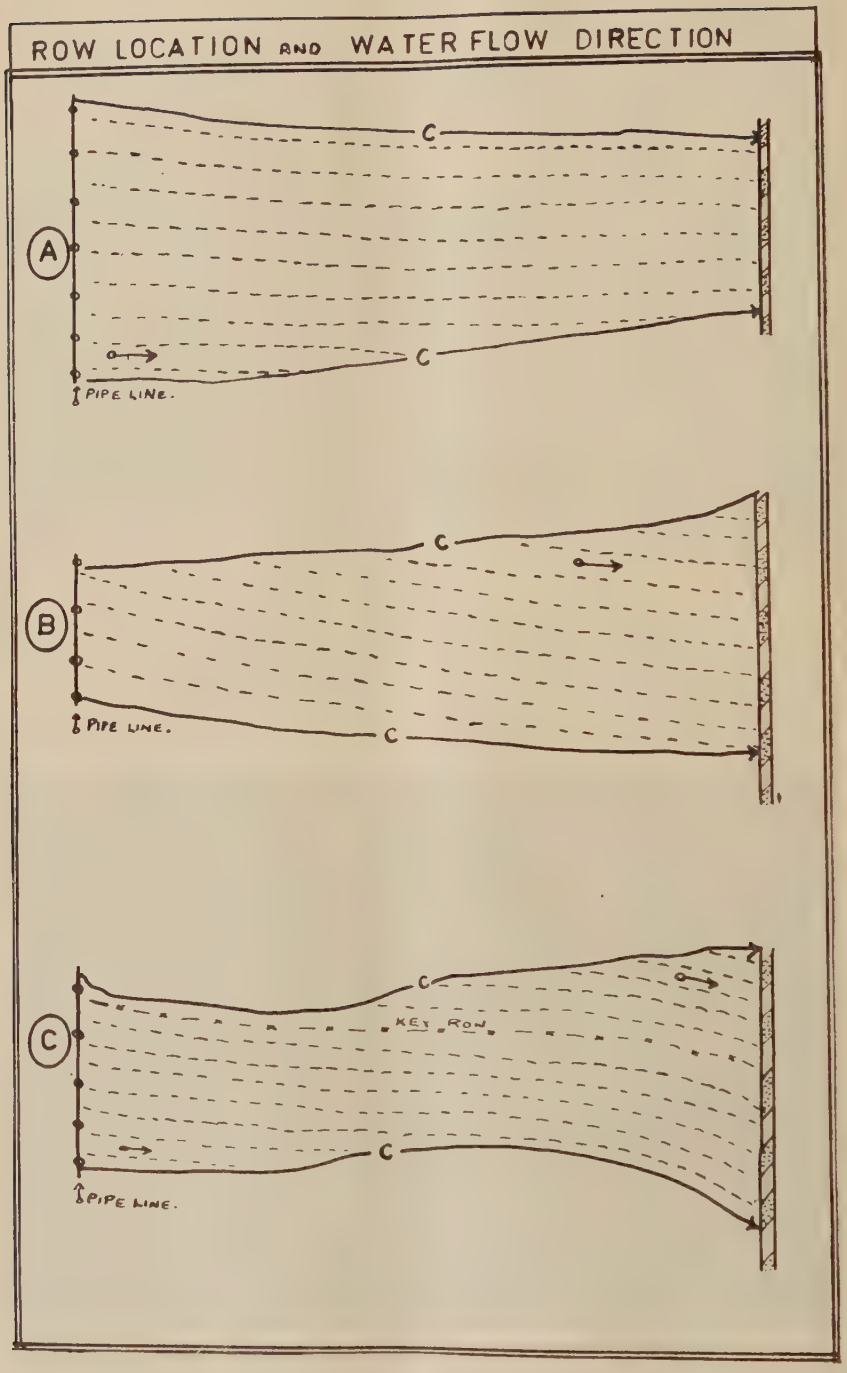


Plate 8.

The Placing of Rows in Relation to Surveyed Contour Banks so that Water will Flow from the Pipeline to the Waterway. (For explanation see opposite page.)

A. Shows contour banks converging towards the outlet. Distance between contour banks is less at the outlet end, which indicates that ground slope is steeper at this end. Consequently, rows should be planted parallel to the **upper** bank. Water will then all flow away from the pipeline. Row gradients will be equal to, or greater than, the grade in the upper contour bank.

B. Shows contour banks diverging toward the outlet. In this case rows must be planted parallel to the **lower** bank if the water in them is to flow in the right direction. If they were planted parallel to the upper bank the gradient would be less than that in the contour bank for rows close to it and the water would flow in the wrong direction in rows further down.

C. Shows the contour banks at first converging, then diverging. A key row is marked out parallel to the upper bank while the banks are converging and then parallel to the lower bank from the point where the banks start to diverge. The remaining rows are planted parallel to the key row.

of the bay as far as it paralleled the contour bank and then along the lower edge of the contour bank into each of the short rows in turn.

A larger nest of short rows in this position would need a special water furrow along the full length of the contour bank. This would be quite practicable, but short rows adjacent to the pipeline are more easily watered. It is for this reason that location of the pipeline is recommended where space between contour banks is widest.

Disposal of Surplus Water.

As the area treated was surrounded by uncleared land on three sides, it was possible to run the furrows out past the edge of the cultivation, and surplus water and runoff from storms were discharged on to the grassland.

Plate 9.

Short Rows. A view from the central pipeline looking down several short rows to the contour bank in the right foreground. (Photographed during harvesting.)

There is a risk of gully development, however, at the discharge point, and the construction of a waterway to carry runoff water safely from the drills and the contour banks is necessary. It is important that such a waterway be stabilised with tar or grass. In view of the small areas involved, the use of tar sprays for immediate stabilisation has much to commend it. Runoff from irrigation water may be slight but runoff from storm rain during the ensuing wet season will be high. The waterway must be designed for this storm-water runoff. Unless it is stabilised, gully erosion will surely occur.

Cultivation.

Cultivation of the long rows presents no problems. Cultivation of the short rows might at first sight appear difficult but in practice is quite simple.

It is best with a crop such as tobacco to run the tractor out from the short row into the lateral track along the contour bank. Then proceed to the end of this track, or back to the central roadway, whichever is the closer. Turn and come back to the next short row or run up the centre roadway to the next short row as the case may be (Plates 6 and 9).

Cultivation does not form such a big part of the expense of producing a tobacco crop, so the cost of extra running is not important. It is far more important to be able to furrow irrigate, as opposed to spraying, and to have the rows on the proper grade to avoid uneven watering and erosion.

Contour Banks as Roads.

The contour bank channels are not planted but are kept free to serve as lateral roadways through the crop. They are necessary to allow access to the short rows for cultivation and are very handy at picking time. At regular intervals along the rows, the pickers can make their way to the contour bank roadway and place the leaf on the stretchers.

On lesser slopes and with an early crop, the hilled tobacco rows should serve as adequate protection against erosion and the contour bank as such may not be required. In such cases, the banks need not be built but roadways may be established on the contour bank line, which will serve as a guide line for planting just as the contour bank would do.

APPLICATION TO OTHER AREAS.

This article deals mainly with the irrigation of a particular area of tobacco with some suggestions as to possible further application on similar areas. The irrigation method followed on Loccisano and Son's crop gave satisfactory results, especially considering that planting was late in the season (Oct. 20) and old plants (15 weeks) were used.

It is the author's opinion that if the principles outlined are followed, successful furrow irrigation can be achieved on most tobacco soils on slopes at least up to 6 per cent. and possibly up to 8 per cent. The information should be of value to anyone attempting irrigation of tobacco on such slopes.

Nematode Control in Pumpkins

By R. C. COLBRAN, Entomologist.

In Queensland three species* of root-knot nematodes infest pumpkins, and severe root galling is common in this crop when grown *on the lighter soil types*. Heavy infestations interfere with vine growth, and under some soil conditions secondary organisms induce premature breakdown of roots with consequent further reductions in yields.

These pests infest pumpkins at all temperatures at which the crop can be grown in Queensland. Even in areas where pumpkins are planted in May and are subject to frosts, the young plants may be heavily infested by late July.

CONTROL.

Field Fumigation.

Satisfactory control can be achieved at small cost (approximately £2 per acre for fumigant) by "spot" fumigation with EDB† (12½ per cent. v/v) and is worthwhile in fields which were heavily infested in previous seasons.

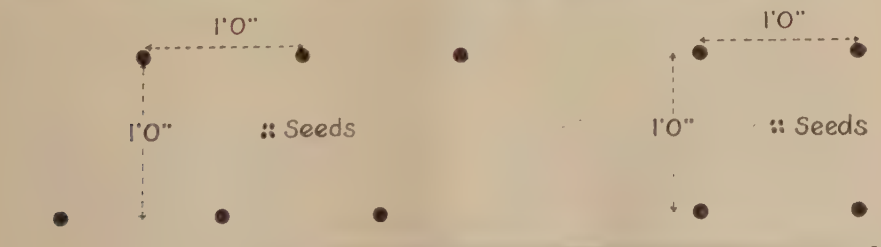
By this method an area around each planting site is treated and the young plant will then be well established before its roots reach soil where large nematode populations are present. The fumigant is injected in holes 6 in. deep at the rate of 1 fluid oz. per 14 holes. A number of injection patterns are suitable; two of these are illustrated below.

Hand injectors are most suitable for "spot" fumigation. When a machine injector is available, double-row treatment may be used. The cost will be higher, as the fumigant should be applied in rows 6 in. deep and 1 ft. apart, 6 in. each side of the planting line, at the rate of ¼ pint per chain of each row.

Provided the soil is not wet, pumpkin seed can be planted immediately before or after fumigation without affecting germination. If "shot" seed is used, however, fumigation should be carried out two weeks before planting so as to avoid injury to the young plants.

Crop Rotation.

In fields where pumpkins have been heavily infested, the most suitable cover crops for helping to reduce nematode populations are velvet beans, Sudan grass and *Crotalaria* species (including Gambia pea).



* *Meloidogyne javanica* (Treub) Chitwood
Meloidogyne hapla Chitwood
Meloidogyne incognita (Kofoid & White) Chitwood

† Sp.G. $\frac{25}{25}$ 2.170

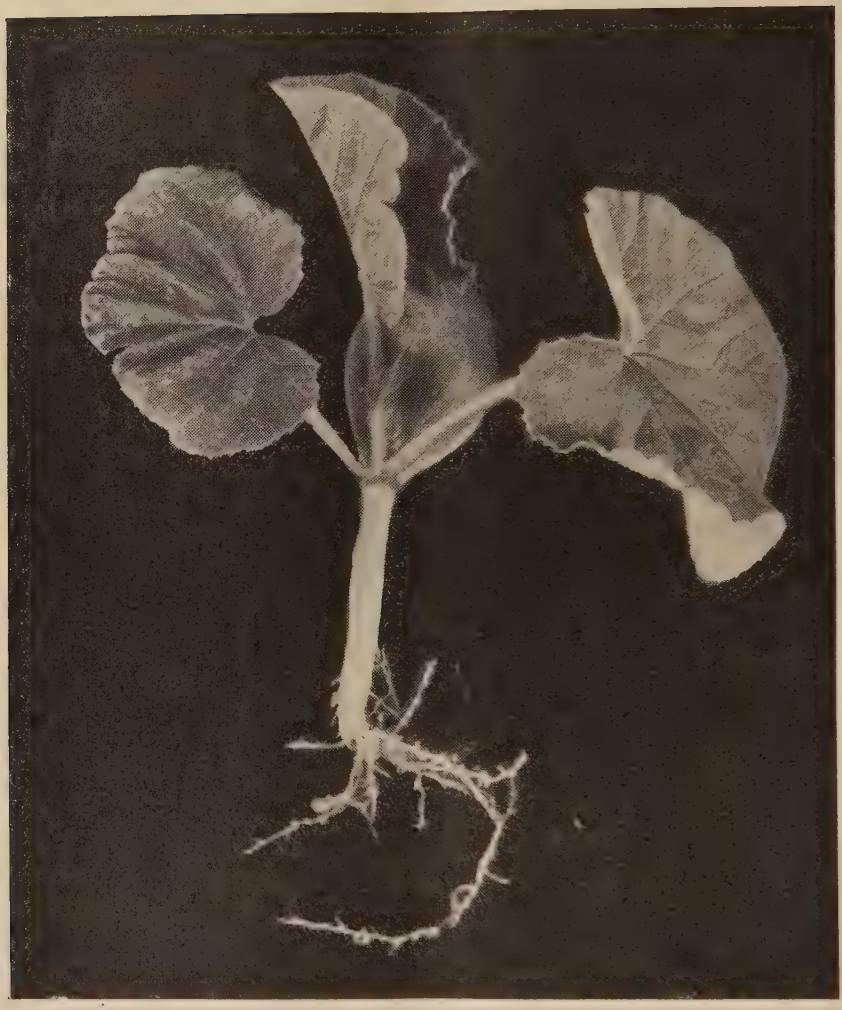


Plate 1.

Young Pumpkin Plant Infested with Root-knot Nematode (Meloidogyne incognita).

WARNING.

Fumes from EDB in a poorly ventilated room are dangerous. Splashes of the concentrate should be washed off immediately with soap and water, and any clothes which are splashed should be changed immediately and not worn again until they have been washed.

Plate 2.

Root Systems of Two Pumpkin Plants of the Same Age. That on the left is heavily infested with root-knot nematodes; that on the right was grown in fumigated soil and is free from the pest.

CLEAN YOUR SPRAY EQUIPMENT.

Thorough cleaning of spray equipment used for pest and disease control in horticultural crops is important. Unless this is done, crop damage may result.

Residual spray materials in the tank and hoses may react with other chemicals, used in subsequent spray treatments, and thus cause plant injury. If spray residues in the tank dry out, removal is more difficult, and the material may flake off and block the spray jets. Cleaning of jets and strainers while the spraying of a crop is in progress causes unnecessary delay and inadequate crop coverage.

Spray equipment can be cleaned of most insecticidal and fungicidal materials by careful washing with clean water. When spray equipment is used for weedicides, efficient methods of cleaning are satisfactory for most contact types such as PCP, arsenical and sodium chlorate formulations. If hormone-type weedkillers are used you cannot always be sure that ordinary cleaning of equipment has made it safe for spraying hormone-sensitive plants.

Since most horticultural crops are susceptible to injury from hormone-type weedicides, and cleaning of spray equipment is not easy, it will be safest in the long run to reserve some equipment solely for the application of weedicides.

THE MOUSE SPIDER.

During the past two years numerous specimens of the mouse spider (*Missulena occatoria* Walckenar) have been forwarded for identification to this Department from many different areas, including Brisbane, Gympie, Kingaroy, Roma, Longreach and Cunnamulla.

This spider has never been recorded as harmful, being non-aggressive and rather inactive, but as it has large poison-bearing fangs it is potentially dangerous.

The two sexes are quite distinct in appearance and for many years were believed to be separate species. The male, or red-headed trapdoor spider, is ½-¾ in. in length, with abdomen velvety-black to deep blue, cephalothorax bright red and legs black. He wanders about and is commonly seen in the open, especially following rain.

The female is much larger, being about 1½ in. long by ¾ in. broad, brownish-black and thickset. She burrows into the ground, forming a tunnel which can be up to 4 ft. deep; hence the name mouse spider. This tunnel has no trap-door.

—*R. P. Kleinschmidt.*

Plate 1.

Female Mouse Spider.

(*After McKeown.*)

Plate 2.

Male Mouse Spider.

(*After McKeown.*)

Velvet Beans in the Beerwah District

By J. O'ROURKE, Adviser in Horticulture.

During the past decade, the pineapple industry in the Beerwah district has undergone a gradual change. At one time, plantations were invariably established on virgin land and new ground was brought into production when crop yields in any particular area became unprofitable. In those days, land was relatively cheap and individual properties large. In recent years, however, the competition for land in recognised pineapple areas has resulted in extensive subdivision and much of the crop is now grown on replant land.

Where land is regularly cropped with pineapples, steps must be taken to maintain soil fertility by measures which suit the district and which are within the compass of the average grower. This is particularly necessary when the farm income depends almost entirely on returns from a single crop. In such cases, green manures are grown during the inter-cycle period. The performance of recognised species such as Poona pea and maize which do well in other horticultural areas has been highly variable at Beerwah, and this may explain the present interest in velvet beans, a species which is better able to tolerate somewhat harsh conditions.

The Cover Crop.

A cover crop can only be satisfactory if it grows well in the district and adds a considerable amount of organic matter to the soil when it is turned in. When it follows pineapples the species used should not be fastidious in its seedbed requirements. It should be able to smother the sometimes dense weed growth which develops in old land, and it should cover the ground for a period of about 12 months, either as the growing plant or, if the crop matures early, as a surface mulch. The velvet bean meets these specifications.

The several varieties and strains of the velvet bean (*Stizolobium deeringianum*) differ a great deal, but the best known and probably the most readily available is the Black Mauritius bean. It is typically a deep-rooted plant which, when established, can withstand prolonged dry weather. The vine has a long growing period and matures its seed in approximately seven months from sowing.

When grown at Beerwah during the summer months, the crop forms a dense ground cover some 3-4 ft. high. A considerable amount of leaf fall occurs when the vines are maturing and results in a dense mass of decaying leaves on the ground. This leaf fall is probably due to insufficient light in the lower regions of the vine. The green material from an average crop weighs about 13 tons per acre, but much higher yields have been recorded under good conditions.

Handling the Crop.

The velvet bean is generally planted early in spring, preferably before the middle of October. On old pineapple land, drills are opened up about 4 ft. apart after the residues from the pineapple crop have been broken up and incorporated sufficiently into the soil to provide a rough but reasonable seedbed.

The seeds, which are large and covered with soft hairs, are planted by

Plate 1.

Velvet Bean Crop in Flowering Stage. Note the dense ground cover and the absence of weeds.

hand or machine planter at spacings of about 1½ ft. and lightly covered with soil. Wide spacings in the row (up to 6 ft.) are sometimes used to reduce the outlay on seed and to simplify cultivation by hand or implements when the plants are young. With a 4 x 1½ ft. spacing, about 15 lb. of seed is required for each acre of land. On ground which has not previously grown velvet beans, the seed should, of course, be inoculated with the appropriate strain of Rhizobium.

On the less fertile soils, a 4:15:2 mixture may be broadcast at the rate of 4 cwt. per acre before planting to ensure a full crop. Where the previous pineapple crop has been adequately fertilized, the residues in the soil are, however, frequently sufficient for normal growth of the green manure crop.

The velvet bean is an extremely vigorous plant with a long, twining vine. Turning in the green matter from a mature crop can be a difficult problem unless the grower has suitable equipment. A tractor-drawn plough with 30 in. discs does an excellent job; the trash is almost completely buried in a single operation and decomposition of the raw organic matter proceeds rapidly. It is probably the best implement for handling the crop when the land has to be got ready for an autumn planting of pineapples.

Where heavy equipment is not available, disc harrows are reasonably satisfactory. Several cuts at right angles to each other will, however, be necessary before normal tillage operations can be applied to prepare the land for planting pineapples in autumn.

The rapid decomposition of the residues from the velvet bean crop is less important in land which is to be planted with pineapples in spring. In this case the green manure is allowed to mature and die down. The vines then become very brittle and can be incorporated in the soil by discing at any convenient time when the soil is in the right condition for cultivation.

The Intercycle Crop.

Investigations at the Maroochy Experiment Station have shown that no advantage is obtained on sandy loams by extending the intercycle period between successive pineapple crops beyond 18 months.

Where pineapples are grown on a two-crop cycle (plant and first ratoon), the ratoon crop is usually harvested either in the May-June period or as a winter crop. If the residues are broken up immediately, velvet beans can be sown in the following October without any difficulty. The initial growth of the vines may appear slow, but this is somewhat of an illusion due to the wide spacing practised and the somewhat irregular germination which occurs in most plantings. Under normal conditions the crop should be well established before the onset of the wet season, when it will not only smother weed growth effectively but also eliminate any possibility of damage from soil erosion. Later in the year, the land can be prepared for a spring planting of pineapples without any difficulty.

Decomposition of pineapple crop residues in sandy soils is normally slow. A cover crop such as the velvet bean hastens the breakdown of these residues, for the wet, moist conditions at ground level under a dense mass of vegetation are favourable to the micro-organisms associated with the process.

Plate 2.

Row Planted Velvet Beans. For some weeks after planting, growth is slow, but later, the weeds are completely smothered.

[*Photograph by courtesy of the Bureau of Sugar Experiment Stations.*

Restrictions on Plant Imports

The importation of plant material from overseas countries into Australia is covered by regulations and proclamations of the Commonwealth Quarantine Act, administered by the Commonwealth Department of Health. In Queensland, all inspectional work at the approved places of entry is carried out by Inspectors of the Department of Agriculture and Stock, who hold authority under the Commonwealth Quarantine Act.

There is a complete prohibition of the entry of plant material which could be a potential carrier of any pest or disease not present in Australia. In this category are—

(1) All stone fruit trees or parts thereof grown in any country in which any of the diseases known as peach yellows, peach rosette, little peach or phony exist.

(2) All gooseberry plants or parts thereof from any country in which American gooseberry mildew exists.

(3) All sugar cane and banana plants (exclusive of the fruit of the latter) grown in any country in which the sugar cane beetle borer, the banana weevil borer and related insects exist.

(4) Broom millet.

(5) Chestnut plants.

(6) Hop plants grown in any country in which either downy mildew or mosaic exists.

(7) Citrus plants, including the fruits but exempting the seeds, from any country in which citrus canker exists.

(8) All plants of the elm family.

(9) Apple and pear trees from any country in which fire blight or pear blight exists.

(10) Cactus plants.

Some plants can only be imported under permit and must undergo treatment on arrival and a definite isolation period after treatment. In this class are avocadoes, grape vines, strawberries, cotton seed, potatoes, raw cotton, logs and sawn timber, rice seed or plants, straw, vegetables, nursery stock, peanuts and seeds and plants of flax, tomato, French beans, soybeans, maize, millet, tobacco, sorghum, oats, barley, rye and wheat.

A person shall not import any nursery stock into Australia unless he is an approved authority and is the holder of a permit issued by the Director of Plant Quarantine. In order to qualify as an approved authority, the intending importer must have facilities for growing the plants in complete isolation for a definite period.

Cultivation in the Vineyard

By D. E. TAYLOR, Horticulture Branch.

Land management in horticultural districts is largely concerned with maintaining the soil moisture at a level which is suitable for the particular crop grown. This is not surprising, for water plays an important part in plant growth. During the growing period from germination to maturity, for example, the amount taken up through the roots and transpired through the leaves in the form of water vapour may be 250 or more times the weight of the mature plant itself.

Water is not only a constituent part of the many substances which make up the plant but also is the medium by which nutrients are carried from one part of the plant to another.

Variations in Soil Moisture.

After heavy rain, the soil does not remain saturated for any length of time. Its moisture content is reduced partly by drainage, partly by evaporation from the surface and partly by the absorption of nutrients in solution through the root systems of the growing plants. The percentage of moisture in the soil therefore becomes progressively less until very little is available to the plant. At this stage the plant or crop wilts, although it may recover and resume normal growth should rain fall or the land be irrigated.

In the absence of rain or irrigation, a point is ultimately reached at which the plants are unable to obtain any moisture at all from the soil and also fail to respond when water is applied. The percentage of moisture in the soil at this stage is known as the wilting point.

Availability of Moisture.

The amount of water in the soil which can be used by the crop is

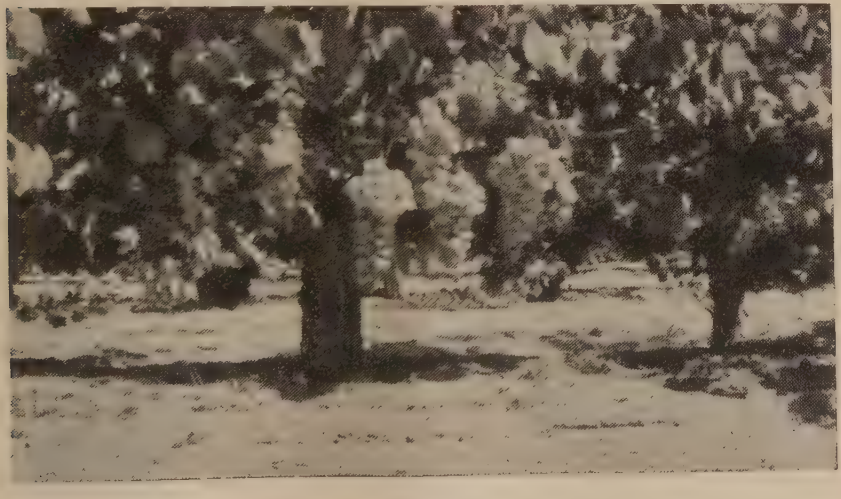


Plate 1.

Waltham Cross Grape Vine in Fruit at Stanthorpe. Note the coarse granitic sand which is typical of vineyards in this district.

approximately the difference between its field capacity (the moisture content after free water has drained away) and its wilting point. Plant growth and development normally take place so long as the soil moisture does not exceed field capacity or fall below wilting point. The actual amount in the soil at any one time varies with the stage of the development of the crop and the frequency of rain or irrigation.

Both field capacity and wilting point vary greatly with the soil type. Typical values are shown in the following table:—

Soil Type.	Field Capacity.	Wilting Point.	Available Moisture.
	%	%	%
Sand ..	10	6	4
Sandy Loam	16	6·4	9·6
Loam ..	25	10	15
Clay Loam	30	12	18
Clay ..	40	16	24

Sandy soils have a low field capacity, a low wilting point and a low reserve of available moisture after rain or irrigation. Characteristically, crops grown on them soon show signs of stress during dry weather and quickly respond to light rain.

Clay soils, on the other hand, usually support a crop during dry weather for quite long periods without any marked signs of stress, but, once stress symptoms become apparent, heavy rains are needed before growth is resumed.

Between these extremes of sandy and clay soils are the mixtures of sand, silt and clay which make up sandy loams, loams and clay loams, all of which are used extensively for horticultural purposes.

Stanthorpe Soils.

Soil is the raw material of a vineyard and is a product of weathering over a very long period of years. Its preservation is an essential feature of good land management.

Where the structure is good, the soil has a distinct "crumbiness" and contains a large proportion of sizable granules between which the vine rootlets can penetrate fairly easily. These crumbs can be easily destroyed if they are excessively "pounded" by the implements used for cultivation and the end result is a soil which is difficult to cultivate and of low productivity.

The soils of the grape growing areas in the Granite Belt vary in fertility, texture and depth. Generally speaking, they may be described as sands and sandy loams which are reasonably well-drained, acid in reaction and poorly supplied with plant foods. Although good drainage is usually a feature of these soils, bands of shallow, impervious subsoil and intrusive rock bars give rise to drainage problems in some areas. The subsoil varies considerably and may be a white sand, a yellow sandy loam or even a clay loam.

Cultivation in the Vineyard.

The grape vine is a very accommodating plant and will adapt itself to a great variety of soils. However, good drainage is essential; the somewhat shallow-rooted grape will not survive in wet situations. Some of these are characterised by an underlying hard-pan induced by faulty tillage practices.

Cultivation practices in the vineyard have a marked influence on both the growth of the vine and its productive life. For example, regular deep cultivation over a number of years often has an adverse effect on plant vigour and yields. Only the spring cultivation should penetrate to any depth; skim cultivation should meet all normal requirements at other periods of the year.

With the advent of tractor-drawn implements which automatically speed up tillage operations, over-cultivation has become commonplace and the surface soil in many vineyards to-day is kept more or less loose and powdery

throughout the year. In such vineyards, the soil is virtually structureless and water loss by evaporation from the surface is excessively high. The time has certainly arrived for a re-appraisal of tillage practices.

The main benefits obtained from cultivation in the vineyard are the destruction of weed growth before it competes with the vines for the available soil moisture and the breaking up of the surface crust which might interfere with both the intake of water by the soil during rain and the movement of air through the soil after rain.

Plate 2.

Scuffler For Weed Destruction. The hand-operated disc gives precise control over "tracking" in the trellis row; without this control, injury to the vines is almost unavoidable.

Plate 3.

New Zealand Blue Lupins in the Vineyard. Lack of organic matter is a major problem in Stanthorpe soils and winter green manures are therefore grown each year.

In the Stanthorpe district, the amount of cultivation required depends largely on the soil type, the rainfall and the weed growth in the vineyard. The soil type determines the "crusting" tendency of the soil, while the incidence of rainfall determines the erosion hazard. Weed growth, although of some value in the wet season, must be controlled in spring and early summer, when the available soil moisture is barely sufficient to supply the requirements of the flowering and fruiting vines.

A rough surface tilth is preferable to a fine tilth in the vineyard and presents no problem where green manuring is regularly practised. It is obtained by using a disc cultivator with a shallow cut for turning in the green manure crop in August. The discs should be of the cutaway or scalloped type; these pulverise the soil to a lesser extent than the plain discs. When the land is more or less free from vegetation, the tine cultivator affords a choice of implements.

In some vineyards which have been subject to continuous clean cultivation for many years, the land will not even grow weeds. This is a sign that organic matter is urgently needed. When organic matter is lacking, a hard crust forms on the surface of the soil after rain. Such a crust not only prevents soil aeration but also increases the risk of erosion; it must be broken by cultivation to improve the absorptive capacity of the soil when rains fall.

The remedy is systematic green manuring during the winter months with crops such as New Zealand blue lupin, wheat and rye, all of which do well in the district when planted at the right time and adequately fertilized.

Queensland Fauna Sanctuaries

By C. ROFF, Fauna Officer.

Sanctuaries are an important wildlife management device and few successful fauna conservation programmes have been undertaken without using the sanctuary system. With increasing human pressure these must play a larger part in conserving fauna in Queensland.

All islands that form part of the State of Queensland, *all* National Parks, *all* State Forest Reserves, and many other areas and private properties have been declared sanctuaries.

A series of maps have been prepared to satisfy an increasing public demand for information concerning the location of the many fine mainland sanctuaries declared in this State.

The following is an index of the sanctuaries outlined in Map 1:—

SANCTUARY INDEX.

Index No.	Sanctuary.	Area in Acres.
1	North Queensland Coast and Atherton Tableland. (This area includes a number of State Forest and National Park Reserves)	3,235,000
2	Butcher's Hill Station, via Cooktown	95,360
3	Alliance and Ibis Dams, Irvinebank	1,600
4	Oakey Creek Dams, Coolgarra, via Mount Garnet	8,048
5	"Happy Days", Mission Beach, Tully	293
6	Oakwood Lagoon, Tully	59
7	Bellenden, Tully	9,286
8	State Forest Reserves 344,350,461, Cardwell	106,300
9	Gunnawarra Station, Mount Garnet	19,998

Plate 1.

Jungle Lands in the North Queensland Coast and Atherton Tableland Sanctuary.
West Palmerston, between Innisfail and Millaa Millaa.

Map 1.

Map Showing Sanctuaries in Part of Fauna District No. 3. The sanctuary boundaries are delineated by dotted lines.

[TO BE CONTINUED.]

Enterprise and Achievement

By O. L. HASSELL (Senior Adviser in Agriculture) and A. HUTCHINGS (Senior Adviser, Cattle Husbandry Branch).

In 1928 young Ted Newton started clearing a 100-acre dry paddock, and later a 120-acre paddock of poor forest land, on the edge of the wallum country near Caboolture. Last year he took 5½ tons of butter off the 120-acre paddock.

This story tells of the achievement of a persevering man and his family

With the exception of 11 acres of alluvium adjoining the Caboolture River, the soil on the Newton farm is a shallow grey clay loam overlying yellow clay and red clay loam overlying reddish clay.

Until 1949 there were five paddocks. The pastures consisted of blue couch with some paspalum, blady grass and blue grasses. There was little clover, but in some summers the legume *Lespedeza striata* appeared.

Plate 1.

The Last Clump of Original Forest on the Farm.

Plate 2.
Native Pasture before Improvement.

Such pasture is typical of that on a large area of coastal dairying land.

The feed consisted of pastures and occasional grazing crops, supplemented by meal and by hand-feeding fodder cane and other crops.

Dairy production was the only source of income and still is the main source. Over the years, production was built up to approximately 9,000 lb. butter.

Developing Pastures.

In 1949 Mr. Newton agreed to co-operate in a non-irrigated pasture demonstration under the Commonwealth Dairy Industry Extension Grant. Rhodes grass, green panic and lucerne pastures grew satisfactorily. Production increased to 9,061 lb. butter in 1949, 10,402 lb. in 1950; it was 8,896 in the drought of 1951, and rose to 10,271 in 1952.

The possibilities of irrigating by the spray system from the adjacent Caboolture River were investigated. In 1952, nine acres of irrigated pasture was planted on an old cultivation on the alluvial soil. The pasture mixture consisted of phalaris, H.1 ryegrass, perennial ryegrass, cocksfoot, paspalum, red clover, white clover and lucerne. The ryegrasses, cocksfoot, phalaris and red clover commenced to die out after the first year. The pastures were spray-irrigated at intervals of approximately 3-4 weeks and topdressed once a year. The area was subdivided into 1¼-acre paddocks.

In the second year yields reached their peak. Representative sampling before each grazing showed the green feed yield per acre for the best soil to be 70 tons a year and for the poor soil 30 tons.

Systematically, at intervals of about 3-4 weeks each paddock was subdivided by an electric fence and the enclosed portion grazed.

It was calculated that the cows were only half-filled on the pasture. Nevertheless, meal allowance was

reduced. Production increased to 11,928 lb. butter in 1953 and 12,141 lb. in 1954.

Floods in 1954 damaged this excellent pasture. The best grasses became less noticeable and couch grass spread. A few patches of Johnson grass appeared but were killed by spraying with sodium chlorate. The whole pasture has now deteriorated to such an extent that Mr. Newton intends to replant it all.

In 1953 an 11½-acre paddock 80 ft. above river level was prepared and planted to improved pasture under flood irrigation. The soil is a shallow grey clay loam overlying yellow clay subsoil. The pasture mixture consisted of phalaris, H.1 ryegrass, paspalum, red clover, white clover and lucerne. This pasture has produced a large quantity of good feed. Despite good management the pasture is changing to a paspalum-white clover mixture. With continued good management such a mixture may be expected to produce satisfactory grazing.

During 1955 butter production increased to 13,532 lb. Meal feeding was reduced in 1955 and at the end of that year was stopped. The 11½ acres of flood-irrigated pasture contributed substantially to this increase in production.

In 1956 a 10-acre Rhodes grass-green panic paddock was ploughed up, prepared and planted to paspalum, H.1 ryegrass, perennial ryegrass, red clover and white clover. Seven acres were laid out for flood irrigation and three acres on a

Plate 3.

Rain-grown Pasture. Left, improved; right, untreated.

Plate 4.
Mowing Ungrazed Patches.

slight slope were laid out for contour irrigation. This area is now a good pasture.

During 1956 the original nine acres of spray-irrigated pasture deteriorated considerably and little feed has been obtained from it. Butter production for 1956 was 12,691 lb.

Another 6-acre paddock is now being prepared for irrigated pasture planting in 1958.

TABLE 1.
BUTTER PRODUCTION, 1949–1956.

Year.	Butter Produced.	Remarks.
	lb.	
1949	9,061	Pasture improvement started—no irrigation
1950	10,402	
1951	8,896	
1952	10,271	9 acres spray-irrigated pasture planted; concentrate purchases reduced to half
1953	11,928	
1954	12,141	11 acres flood-irrigated pasture planted
1955	13,532	Concentrate purchases ceased
1956	12,691	10 acres flood and contour ditch irrigated pasture planted

Plate 5.
Spreading Droppings.

Subdivision.

The 120-acre dairy farm is now divided into 40 paddocks. The electric fence has been superseded by more permanent barb-wire fences which divide all irrigated areas into 1-acre paddocks. Permanent fences are suitable to the grazing system now carried out. Mr. Newton prefers these fences to electric fences. The main laneway through the middle of the farm, allowing access to many paddocks, is two chains wide. There is thus no narrow laneway to become a quagmire in wet weather for the travelling herd.

Grazing and Mineral Supplements.

Milking cows numbering up to 65 are given a fresh grazing paddock each night. Day grazing is largely on non-irrigated pasture or crops or on old irrigated pasture on occasions.

Blood samples taken from a number of cows in October, 1954, showed phosphate and copper deficiencies. Since November, 1954, a mineral mixture composed of 50 lb. salt, 50 lb. sterilized bonemeal and 1 lb. copper sulphate has been fed at the rate of 4 oz. a cow daily. This is added to a small amount of chaffed fodder cane and a small tinful of bran or pollard during milking. It is considered that this mineral supplement is playing a part in better production.

Bloat has never occurred, even when clover has been dominant in the pasture. One reason for this is that cows have never been ravenously hungry. It has been suggested that the small amount of cane eaten helps

Plate 6.
Fertilizing the Pasture with a Fertilizer Spreader.

to prevent bloat, but this is not certain.

Irrigation.

Electricity was brought to the district within the past two years. A 15-h.p. electric motor was installed to drive the 3 x 2½ in. pump.

When rain is insufficient, irrigation is supplied at 2 in. per acre a fortnight. Water is pumped through 4-in. galvanised pipes to open earth drains to the various flood-irrigated and contour-irrigated paddocks.

There are now 30 acres of irrigated pastures. It takes 12 days to irrigate the total at 24 hours daily on the flood and contour paddocks and 12 hours daily with spray irrigation.

Electric power costs 1s. 11d. per hour. Pumping at 60 points an hour through open pipes thus costs 3s. 3d. per acre-inch for flood and contour irrigation. Electricity for spray irrigation costs approximately 6s. 5d. per acre-inch. Labour is also more costly for spray irrigation.

Fertilizing.

A spreader is used for all fertilizing and seed planting. An application of 2 cwt. lime and two bags of copperised superphosphate per acre is made before planting. Thereafter one bag of super per acre is put on in late summer and spring. Copperised super is occasionally used instead of straight super. The phosphate stimulates clover growth, which in turn supplies nitrogen for grass growth. Sulphate of ammonia at 56 lb. per acre has been used occasionally to stimulate growth generally.

Outstanding results have been obtained by topdressing with ½ ton fowl manure per acre.

The manurial value (in nitrogen, phosphorus and potash) of the dung of a cow is worth up to £18 a year—if the best use is made of it.

Harrowing and Mowing.

Each 1-acre paddock is lightly mowed and harrowed with pasture harrows the day after night grazing. Thereby uneaten grass is cut off, dung is spread and a clean table, so to speak, is ready for the next grazing. The mower and pasture harrows should be used on every dairy farm. They are most important in pasture management.

Native pastures have been ploughed, planted to grazing crops, then to Rhodes grass and green panic pastures. So far these improved pastures have preceded planting to irrigated pastures.

Fodder Cane.

Mr. Newton has grown fodder cane for over 20 years. Four acres are at present grown, comprising 13 varieties for trial purposes. Outstanding varieties are Co. 301 and C.P. 29/116, which withstand frost fairly well. Q.60 and China yield heavy crops but are not frost-resistant. Average yield is 40 tons per acre. An application of 3 cwt. of complete fertilizer is made to the cane among the trash

Plate 7.

Dairy Cows Grazing on Improved Pasture.

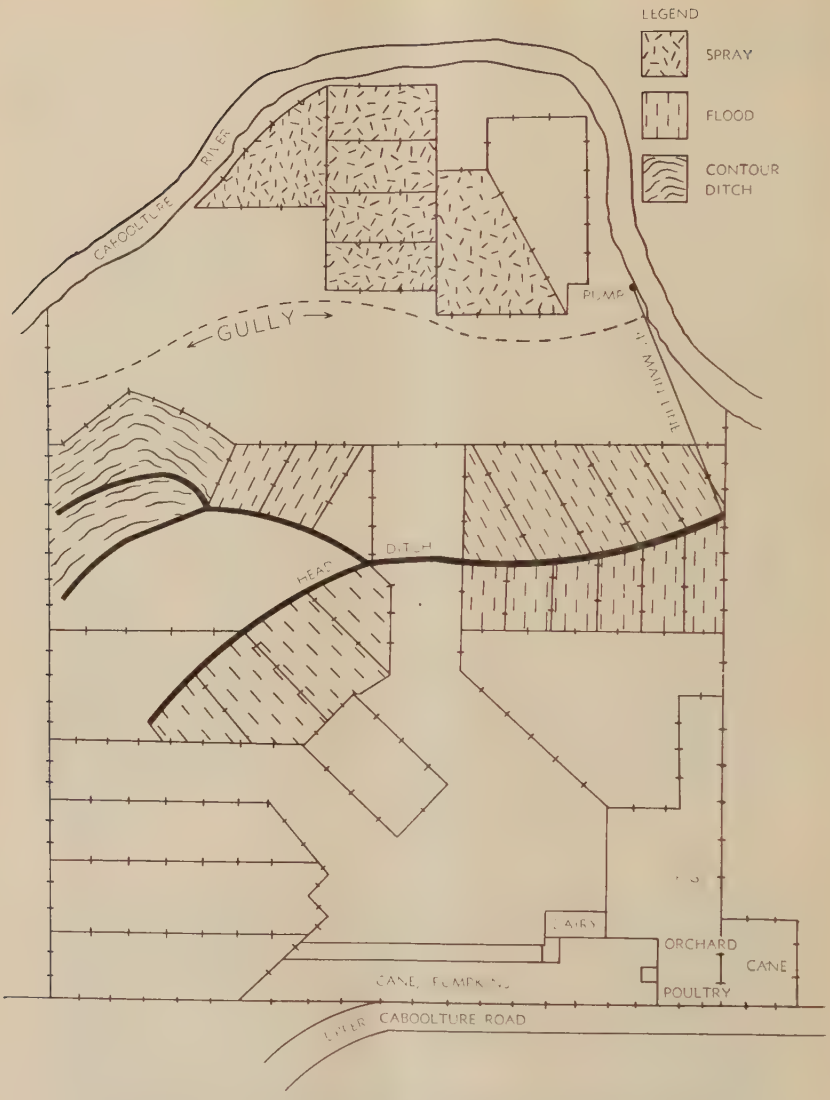


Plate 8.

Sketch of Farm Subdivision, Showing Methods of Irrigating Pastures.

after harvesting. There is no inter-row cultivation of rotation crops. Cane is now grown largely for sale of planting material.

Labour Organisation and the Family.

Mr. and Mrs. Newton have two sons over 20 years old and two daughters in their 'teens. Mr. Geoff Newton, the eldest son, looks after the irrigated pastures—mowing, harrowing, irrigating and topdressing. He keeps poultry to supplement his income. Mr. Bill Newton looks after the young stock, helps in the dairy and grows bananas to supplement his income. Misses Myra and Alice Newton do the dairy work and help in the home. Mr. E. C. Newton, the

father, looks after the fodder cane and pigs. Thus all work is harmoniously organised.

Profits.

As shown in Table 1, butter production has increased from less than 9,000 lb. a year before 1949 to 12,691 lb. in 1956. Purchased concentrates of over £600 a year have been entirely replaced by grazing irrigated pastures. Electricity and labour costs for the pastures are less than £300 a year.

The farm does not return a high income when the number of family workers is considered, but by his love of the land and a will to succeed, Mr. Newton has brought poor land into good production and has kept his family on the land.

STUD BREEDERS HAVE A RESPONSIBILITY.

There is a responsibility on breeders of stud dairy cattle to ensure that the bulls they sell are capable of improving or at least maintaining the production of the herds into which they are sold.

This was stated recently by the Minister for Agriculture and Stock (Hon. O. O. Madsen, M.L.A.) in commenting on the results of production recording of purebred herds for the year 1956-57.

Mr. Madsen said that less than 10 per cent. of members of the five herd book societies had their herds officially production recorded last year. It was obvious, therefore, that many breeders lack authentic knowledge of the capacity of their stock to improve the production of commercial herds. This was a distinct handicap to the commercial dairyman buying a herd sire or foundation female stock.

A number of production records were broken by cows recorded during the year. This was evidence that some breeders are improving their herds by breeding and feeding. Nevertheless, said Mr. Madsen, the fact remains that fewer than half of the cows in the 116 herds recorded reached the standards required for entry into the Advanced Registers of the herd books.

Mr. Madsen said that Registers of Merit are kept for cows producing at a high level over a number of consecutive lactations. During the year, 62 cows qualified for entry in these registers. The importance of the registers is that the progeny of the cows they contain are more likely to inherit high production capacity than those of cows with only one lactation recorded.

The Minister expressed the hope that more breeders would have their herds production recorded regularly so that improvement of commercial herds could proceed on sound lines.

SELF-FEEDERS FOR PIGS.

A self-feeder is a useful aid in reducing the labour requirements in the piggery, but for best results the unit needs regular and careful supervision.

Mr. E. L. Melville, Senior Adviser in Pig Raising, Department of Agriculture and Stock, explains that the primary purpose of a self-feeder is to keep a supply of grain or meal constantly before the pigs, and at the same time protected from the weather. The self-feeder is a hopper holding a bulk supply of food with a trough below. Food in the trough is automatically replenished from the hopper as the pigs use it up. Each unit should be large enough to hold several days' supply of food.

When a self-feeder is filled, it's not simply a matter of leaving it until it's empty. A regular watch should be kept on the flow of food into the trough. In wet weather, for instance, the food may clog and choke the outlet. In addition, the food may become soiled and unpalatable to pigs. Pigs accustomed to a self-feeder eat only a small quantity of feed at a time. However, pigs may show a tendency to overfatness when self-fed, but this can be overcome by adding more fibre, such as lucerne meal, to the ration.

Don't feed your pigs dairy products through a self-feeder. Dairy produce will spoil if you give the pigs more than they can finish at one feed. On dairy farms, your best practice would be to feed grain from a self-feeder and, twice a day, hand-feed sufficient separated milk to balance the ration.

Production Raised 52 Per Cent.

By F. J. SLATTER, Dairy Adviser.

A Yarranlea dairy farmer who has fed his dairy herd according to the production of each cow has been able to increase the amount of butterfat produced by 52 per cent.—from 244 lb. to 370 lb. a cow.

Good feeding and heavy culling, allied with intelligent use of herd recording records, have been behind the success of Mr. G. I. Holmes. His has been one of the three highest producing recorded herds in Queensland for the last three years.

Butterfat produced by Mr. Holmes' grade A.I.S. herd for the last four recording years is as follows:—

Recording Year.	No. of Cows.	Butterfat Produced (lb.).	Length of Lactation (days).
1952–53 ..	37	244	215
1953–54 ..	37	295	268
1954–55 ..	38	325	278
1955–56 ..	31	370	280

The cow that gave the highest amount of butterfat for 1955-56, "Bub," produced 488 lb. fat from milk with an average test of 3.8 per cent. in 270 days.

The farm area is 407 acres and is subdivided into 15 cultivation paddocks and four grass paddocks. All open onto a laneway. The light black loam of this farm is typical of the plain country around Yarranlea. The uncleared areas carry yellow box, Moreton Bay ash and gum.

Bores are so placed that cows have access to a wholesome water supply at all times.

Plate 1.

"Bub," Top Producing Cow in the Holmes Herd. This cow produced 488 lb. of butterfat in 270 days.

Plate 2.

The Holmes Herd Grazing on a Sorghum Crop. Ratoon crops are stripped for grain.

Mr. Holmes believes that the value of herd recording lies in revealing production differences between cows and this has been the basis of his effort to raise the butterfat yield of his herd.

Feeding.

This farmer strives for economical production and for this reason cows are fed on produce grown only on the farm.

The milkers are grazed on the usual fodder crops, such as Sudan grass and sorghum in the summer months and oats, barley and canary grass in the winter. In addition, good native grasses are available. As a large percentage of a cow's grazing is done at night, the best grazing is reserved for that time.

After grazing, the barley and sorghum crops are allowed to ratoon. The grain produced is then harvested and hammer-milled to make a palatable meal.

Meal is fed to cows all the year. It is in this supplementary feeding that cows are treated as individuals. Fed in the bail at milking time, freshly calved and high producing cows are given meal at the rate of 6 lb. a day. The remainder of the milkers are fed according to the butterfat they produce. A cow nearing the end of her lactation would receive 3 lb. of the barley/sorghum meal per day.

Hay is fed to cows in dry and wet periods only. On these occasions cows receive 6-8 lb. of hay a day. Mr. Holmes states it is essential to give cows extra feed to make up for the amount lost when the paddocks are too wet to graze.

He also pays particular attention to the feeding of dry cows. These animals are provided with a paddock of good grass. Springers are brought in and allowed to run with the milking herd at least three weeks before they are due to calve.

Cows on this farm have a liking for mineral licks. These are provided for both milking and dry stock, which consume 24 bags a year.

Fodder Reserves.

About 170 tons of hay is stored for an emergency. The hay is made from lucerne and the usual cereal crops.

In addition to the hay reserves, sufficient grain is stored to enable Mr. Holmes to prepare enough meal to supplementary feed his cows for at least 18 months.

Herd Management.

A visitor to Mr. Holmes' farm soon realises that the herd is well managed. Very few cows require back chains, while a leg rope is almost a thing of the past.

Culling has been strict in this herd, and no cow remains in the herd for sentimental reasons. Females are culled for low production and short lactation.

The culling has been so effective that the average length of lactation for the herd has been increased from 215 days in the 1952-53 recording year to 280 days in 1955-56, an increase of 65 days.

Six replacement heifers are brought into the herd each year. They are all reared on the property. Heifers coming in for the first time are brought into the milking herd three months before calving. They are allowed to graze with the herd and are run through the bail after each milking. One month before they calve, heifers are given a small quantity of meal in the bail. This routine helps to get them used to the milking routine and makes breaking-in a simple matter.

Breeding Programme.

A special feature of the breeding programme on this farm is the records kept by Mr. Holmes. From his herd record book he can tell at a glance the full history of any animal.

The main aim in breeding has been to breed from cows that are high producers and have a long lactation period. Heifer calves are only kept from cows that meet these basic requirements.

Only purebred bulls are used on the property. Line breeding, however, is not practised. Mr. Holmes prefers to buy a young bull with sisters that have high production records rather than to follow a certain strain closely.

A new junior sire, "Yarranvale Pride," was recently brought into the herd. This bull has been selected on the production records of his close relatives and is expected to further increase the production of the Holmes herd.

Good Results.

The increased production obtained by Mr. Holmes is certainly deserving of credit. He has obtained this greater production without incurring undue expense.

The cows are well fed and well managed. Culling is strictly controlled, while a sound breeding and calf rearing scheme is followed.

Generally speaking, the increase can be attributed to the practical application of the old truism, "Feed, Weed, and Breed."

Improved Production on an Atherton Tableland Farm

By C. GIBBS, Dairy Officer.

How does it feel to be the owners of a herd which averages 348 lb. butterfat per cow per year? Mr. and Mrs. K. M. Laws, Malanda, who own such a herd, are justifiably proud of achieving such a production.

The farm is worked by Mr. and Mrs. Laws as partners under the name of K. M. & R. Laws. It is situated six miles from Malanda and lies between the watersheds of the Barron and Johnstone Rivers. The soil is the red volcanic typical of the Atherton Tableland. The dense rainforest was felled 43 years ago.

This area of the Tableland receives an annual rainfall of 65 in., two-thirds of which falls in the wet season from January to April. Fair rains are usually experienced in the autumn and winter, but July to December is comparatively dry.

PRODUCTION.

Mr. Laws has been a member of the Group Herd Recording Scheme since its inception on the Tableland in 1948. His yearly average production has been—

Year.	No. of Cows.	Average Production.			Length of Lactation (days).
		Milk (lb.).	Test (%).	Butterfat (lb.).	
1948–49 ..	17	3,101	3·9	182	..
1949–50 ..	52	5,850	4·0	233	..
1950–51 ..	27	6,416	4·2	268	239
1951–52* ..	26	4,893	4·1	202	261
1952–53* ..	37	4,831	4·1	199	226
1953–54 ..	20	6,168	3·9	242	248
1954–55 ..	35	6,477	3·9	252	263
1955–56 ..	29	8,656	4·0	348	293

* Drought.

From these figures it will be noted that he has almost doubled production in the eight years of recording and his 1955-56 production is 44 per cent. higher than in 1953-54. It is also worth noting that the average length of lactation has increased from 239 days in 1950-51 to 293 days in 1955-56.

How was this increase achieved? Largely by applying the information obtained from continuous herd recording to improve the feeding and breeding practices and general farm management.

FARM MANAGEMENT.

The 140-acre farm is completely cleared and is subdivided into 11 pasture paddocks. Ample water is available in each paddock and is also reticulated to a trough near the milking shed.

The pastures consist of paspalum, kikuyu and white clover. The amount of clover available depends on the

season. A strict rotational grazing programme is followed. After the cows have been removed to a fresh paddock a power mower is used to remove weeds and rank growth. Cow-yard manure is utilized to improve the poorer pastures. No crops are grown, pastures being the main source of food.

HERD MANAGEMENT.

The herd consists of a fine type of grade A.I.S. cow. Mr. Laws has carefully selected his herd sires according to production and at the same time he has not neglected type. He gives much of the credit for the herd to the bull "Fernhome Emily's Hero," purchased from Mr. R. Griffiths "Fernhome," Moregatta.

The herd has been recorded under the Group Herd Recording Scheme since 1948 and the results have been used in the breeding programme. The lower producers have been culled and the culling standard has been increased each year. The higher producing cows have been selected for the breeding of herd replacements.

Advantage has been taken of the service offered by the Department of Agriculture and Stock to have the herd sires surveyed. This has enabled the owners to assess the value of the bulls in use.

SEASONAL CALVING.

Mr. Laws claims that the major influence on his increased production has been the practice of seasonal calving. He has found that by mating his cows to calve during the months of July, August and September he has increased the length of lactation and consequently the production.

SUPPLEMENTARY FEEDING.

As mentioned previously, pasture is the main source of feed. This is supplemented by feeding the cows in the bails during milking. Boxes have been constructed in the dummy bails for this purpose. All cows are fed a mixture of maizemeal, molasses, salt and bone flour. The ratio of the mixture is 2 lb. maizemeal, 3 lb. molasses, 2 oz. salt and 2 oz. bone flour. The amount fed to each cow varies according to the production, season of the year and stage of the lactation, but the above-mentioned rate is the average.

The "steaming up" of cows prior to calving has become routine practice. All cows are fed for 14 days prior to calving at the same rate as cows in full milk. The adoption of this practice has made it necessary to pre-milk the cows—that is, to milk them before they calve. Mr. Laws has found that not only does pre-milking increase production but it has also reduced the amount of mastitis at calving time. In order to still further control mastitis he dries off his cows by ceasing to milk them, as recommended by Dr. Petersen. When they are turned out he injects them with one of the antibiotic preparations.

Mr. and Mrs. Laws certainly have every reason to be proud of the production of their herd, knowing that it has been attained by their own endeavours. They have applied successfully the lessons learnt from herd recording. May the continued practice of sound feeding, breeding, and good cowmanship assist them to attain still higher production.

The dairying industry owes much to such people, who by their initiative have set an example which may be followed profitably by others.

Effect of the Period Between Calvings on Production

By S. E. PEGG, Chief Adviser, Herd Recording.

Does it pay to run the bull with the milking herd?

This practice, which is common in Queensland, allows the bull, not the herd owner, to determine when the cows go in calf, and what will be the period between calvings.

A survey has been conducted to ascertain what effect the period between calving has on the production of the ensuing lactation. This survey was conducted on 19,971 cows from the 1955-56 herd recording year.

It is unfortunate that information regarding the period between calvings was not available for a greater number of cows—19,971 cows represents 43 per cent. of the recorded cows which were on other than their first lactation. The reason for this comparatively low percentage of cows appears to be that very few farmers entering their herds for recording for the first time have kept reliable records.

The percentage of cows calving after varying periods is given in Table 1.

TABLE 1.

PERCENTAGE OF COWS CALVING AFTER VARYING PERIODS.

Months between Calvings.	No. of Cows.	Percentage of Cows.
9	355	1·8
10	3,515	17·6
11	5,099	25·5
12	5,654	28·3
13	2,033	10·2
14	1,236	6·2
15	639	3·2
16	427	2·1
17	248	1·2
18	269	1·3
19	151	0·8
20 or more ..	346	1·7

It is very interesting to note that 18.4 per cent. of the cows re-calved in less than 11 months. This probably resulted from the bull being run with the herd.

The percentage which re-calved after periods longer than 13 months was 16.5. The reason for such a large percentage of cows calving after a period of 13 months can probably be attributed to diseases affecting fertility.

Effect on Production.

The effect of length of period between calvings on the production of the ensuing lactation period is given in Table 2.

TABLE 2.

AVERAGE PRODUCTION OF COWS ACCORDING TO THE PERIOD BETWEEN CALVING.

Months between Calvings.	No. of Cows.	Average Production.	
		Milk (lb.).	Butterfat (lb.).
9	355	3,632	158
10	3,515	3,690	160
11	5,099	4,421	175
12	5,654	3,971	171
13	2,033	3,918	170
14	1,236	3,724	169
15	639	4,112	178
16	427	3,824	174
17	248	4,325	170
18	269	4,016	174
19	151	3,486	152
20 or more	346	3,900	171

From these results it appears that no appreciable increase in production is obtained by calving at intervals greater than 12 months. A definite drop in production is obtained where cows calve at 9 or 10 months after the previous calving date.

The aim to have cows calving at intervals of 12 months appears to be desirable. Longer periods between calvings are uneconomical, as the cows have a lengthy dry spell.

Conclusion.

The point to be derived from this survey is "Control the bull and arrange calvings at regular periods of 12 months after the previous calving."

A.I. ON ATHERTON TABLELAND.

An artificial insemination centre for dairy cattle on the Atherton Tableland has been prepared for a breeding season starting early in September, the Minister for Agriculture and Stock (Hon. O. O. Madsen, M.L.A.) said recently. The centre, which is at the Kairi Regional Experiment Station, is the first to be established outside Brisbane.

Although artificial insemination was carried out from the Kairi Regional Experiment Station last season, the Station was used as a sub-centre of the Rocklea Animal Husbandry Research Farm. There were no bulls on the station and frozen semen was brought by air from Brisbane.

This breeding season, however, six bulls will be kept at Kairi, and the Station will be equipped with its own laboratory and facilities for collecting semen. Three A.I.S. bulls have been obtained locally, and three Jersey bulls have been transferred from Rocklea. The Jerseys have been used in Queensland's Bull Proving Scheme, but their performance has not yet been determined.

Two Advisers in Cattle Husbandry are stationed at Kairi—one to take charge of the bulls and the collection of semen and the other to carry out the inseminations. With the present staff it would be possible to inseminate about 1,000 cows during the coming breeding season.

Mr. Madsen said there is a big demand for an A.I. service from farmers in all dairying districts on the Tableland.

MARGARINE QUOTAS.

The Minister for Agriculture (Hon. O. O. Madsen, M.L.A.) stated recently that his Government had considered the question of the manufacture of table margarine in Queensland.

Mr. Madsen said the previous Government had granted unconditional quotas aggregating 4,236 tons to three manufacturers. On the basis of these quotas each of the three companies had erected or extended their factories and had purchased and installed the necessary machinery and equipment to enable these quotas to be manufactured.

Whilst he had opposed the granting of these increased quotas, nevertheless they had been legally granted by the Government of the day. In the circumstances the present Government felt it would be a breach of faith to reduce the quotas.

The Government has firmly rejected the application from manufacturers to increase quotas and will take all steps necessary to ensure that quotas are not exceeded. Mr. Madsen said that the dairy industry must be protected from unfair competition and he hoped that the Commonwealth Government would see its way clear to increase tariffs on competitive vegetable oils produced by cheap overseas labour.

Importance of Roundworm in Poultry

By P. D. RANBY, Veterinary Officer.

The prevalence of roundworms in our growing poultry stock is sometimes striking. Perhaps this is partly due to our tropical and subtropical conditions, but our husbandry methods are also to blame. Poor management, associated with unsuitable housing, dirty and often inadequate floor litter, overcrowding and faulty feeding, is an important factor.

TYPES OF ROUNDWORMS.

There are two roundworms mainly affecting poultry flocks in Queensland —(1) The large roundworm or intestinal roundworm (*Ascaridia galli*), which lives in the small intestine of poultry; and (2) the small roundworm or caecal roundworm (*Heterakis gallinae*), which lives in the caecum or blind-gut of the bird.

Mature large roundworms measure up to 3 in. long, while the small roundworm reaches only half an inch in length.

As the name implies, roundworms are round in cross-section, whereas tape worms are flat.

Roundworms are prolific egg-layers, so even when a bird carries only a few worms the ground becomes heavily contaminated with eggs. The eggs require about two weeks to become infective and at this time contain a larva or embryo worm.

On the egg being taken in by the bird, the gastric juice of the bird's stomach dissolves the capsule of the egg and frees the larva, which grows to the adult stage in five weeks or so.

Roundworm eggs are very resistant and can survive in the shade for up to a year.

EFFECTS OF ROUNDWORMS.

The large roundworm of poultry is by far the more important of the two. About 10 of these parasites are enough to cause unthriftiness and a certain degree of anaemia in half-grown chickens. Yet worms in numbers far higher than this are commonly found.

Although adult roundworms cause little damage to the lining of the small intestine, their presence has a definite ill effect on the body of the infected bird. Chickens infested by the large roundworm are noticeably pale in the combs and are not well fleshed. It has been shown that complete removal of large roundworms by treatment can result in an extra gain of half a pound in weight in three weeks as compared with similar chickens untreated.

It is the half to three-quarter grown chicken that suffers most from roundworm infestation. After this age fowls become more resistant, due both to resistance acquired as a result of contact with roundworms and to an inherent age resistance. Adult fowls do not carry many large roundworms as a rule—just enough to contaminate ground with roundworm eggs for the chickens to pick up.

In the case of vitamin A deficiency, it is interesting to observe the large numbers of immature roundworms becoming established in adult fowls, which ordinarily do not carry many roundworms. Apart from the various

Plate 1.

Australorp Chickens Infested by Large Roundworm Following an Attack of Chronic Respiratory Disease. Both birds were thin in the breast and light in weight.

functions of vitamin A in the body, it is really also an anti-roundworm vitamin.

Apart from their direct effects, roundworms act as a "stress factor", lowering the resistance of poultry to other diseases. On the other hand, an attack of chronic respiratory disease (C.R.D.) is often followed in its later stages by a heavy roundworm infestation due to continued lowered resistance (see Plate 1).

The caecal roundworm is important in aiding the microscopic blackhead parasite (*Histomonas meleagridis*) which invades the eggs of this worm. Here it is protected and survives inside the worm egg on the ground for many months. Blackhead is a serious disease of turkey poults and also occurs occasionally in chickens.

TREATMENT.

All chickens reared on the ground and held in a pen should be treated *at least once* for roundworms. Considering the cost of treatment, which varies from about a halfpenny to one penny per chicken, this is only a fraction of the cost of rearing a healthy fowl to the laying stage.

When the roundworms are passed out in the droppings following treatment, they may be eaten by some fowls. The worm dies on being eaten, however, and does not re-establish itself in the gut of the fowl.

Treatment of the two poultry roundworms is different.

The Large Roundworm.

(1) Piperazines.

Piperazines are among the newest drugs for the treatment of roundworms and are recommended for large

roundworm of poultry. These compounds are highly effective against the large roundworm of poultry (95-100 per cent. removal), but only partially effective against the caecal roundworm. They are palatable, non-toxic and cheap. Piperazine is administered in the mash or drinking water, depending on the particular preparation used. Thus it can be given as a flock treatment. In short, piperazines approach the "ideal de-wormer" so far as the large roundworm of poultry is concerned.

Piperazines act by paralysing or anaesthetising the worms, and they pass out of the body of the bird by the normal wave movements of its intestines. The worms are seen to appear in the droppings about two hours after treatment and nearly all are voided by six hours.

The dose is made up as directed by the manufacturer according to body weight (100-125 milligrams per kilogram or 2.2 lb. body weight). If given in mash, the piperazine preparation is mixed thoroughly through a small quantity of mash, and this in turn is mixed through a quantity of mash sufficient to be eaten within a day. Wet or dry mash may be used.

If a soluble preparation is given in the drinking water, the volume of water used should be such that it will be consumed by the birds within a day. Automatic watering devices are unsuitable for supplying medicaments in the drinking water. The automatic watering device must be turned off or disconnected and the soluble piperazine supplied in open containers.

As a rough guide, the quantity of water consumed by 100 fowls in a day is as follows:—

Adults—5-6 gallons.
Chickens ¾-grown—4-5 gallons.
Chickens ½-grown—3-4 gallons.

(2) Tetrachlorethylene.

This is an oily liquid commonly used for de-worming poultry and other animals. It is given by dosing the birds individually with either capsules or a special drenching gun. Some caution is required in the case of a drenching gun to avoid drops of the drug escaping in the bird's throat while the gun is being withdrawn from the gullet.

For effective de-worming with this drug the birds *must be fasted* for at least 12 hours before treatment. If the birds are not starved beforehand, efficiency of treatment is considerably reduced. The drug is quite effective at the correct dose in most of the birds, but for some unknown reason, the drug does not work well in odd birds. The tendency is not to give enough.

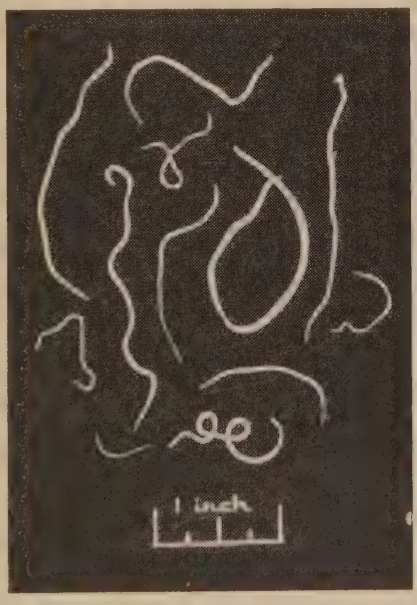


Plate 2.

The Large Roundworm or Intestinal Roundworm. This parasite is found in the small intestine of the fowl, pheasant, turkey and duck.

Plate 3.

Portion of the Small Intestine of a Chicken, Showing Large Roundworms Attached to the Inside Wall.

Disadvantages are the extra work involved in catching the birds and the very occasional poisonous effects. These reactions are more likely in weak birds and in hot weather.

The dose is 1 ml. (1 c.c.) for fowls ¾-grown to adult size (3-4 lb. body weight), and 0.5 ml. (½ c.c.) for chickens ½-grown to ¾-grown (2-3 lb. body weight).

(3) Carbon Tetrachloride.

This is given usually by drenching gun, but capsules also may be used. The drug is very similar to tetrachlorethylene and the same points apply.

The dose is 2 ml. (2 c.c.) for fowls ¾-grown to adult size (3-4 lb. body weight) and 1 ml. (1 c.c.) for chickens ½-grown to ¾-grown (2-3 lb. body weight).

(4) Nicotine Sulphate.

Nicotine sulphate is mentioned because it is an old treatment that is still used occasionally. Other treatments should be used in preference. The drug is cheap but tends to be somewhat unpalatable and is poisonous at sufficiently high doses to kill most roundworms. It is about 75 per cent. effective for the large roundworm and 50 per cent. effective for the small roundworm. Its main advantage is as a flock treatment. The drug is supplied as a powder in a bentonite base or as a liquid ("Blackleaf 40").

Fast birds at least 12 hours before treatment, and use as directed by the manufacturer, in dry mash.

Caecal Roundworms.

Treatment is by phenothiazine (a green powder) in the mash at the rate of one part of drug to 250 parts of mash to be eaten within a day. No fasting is necessary.

Phenothiazine is effective only for the caecal or small roundworm and not for the large roundworm.

Mixed Drugs.

Occasionally phenothiazine and nicotine sulphate are used in combination, either as a powder or in tablets. If nicotine sulphate is used at all, it is preferably used in a mixed form, such as—

Nicotine sulphate 40 per cent.	1 oz.
Phenothiazine	10 oz.
Bentonite	1 lb.
Dry Mash	100 lb.

The mixture is mixed thoroughly, according to the manufacturer's directions, through a portion of the mash, and this in turn is worked through the rest of the mash. This is supplied to the birds for two or three days continuously.

There is no reason why the new piperazine compounds could not be mixed with phenothiazine to treat both poultry roundworms. Fasting would not be necessary.

HUSBANDRY AND ROUNDWORMS.

Do not overcrowd chickens, as this concentrates the droppings and hence worm eggs over a small area.

Chickens with ample free range do not pick up so many roundworm eggs. Cockerels reared on wire for table purposes are generally free of roundworms and this is one reason, among others, why they do better.

If chickens are run intensively, a concrete floor is desirable to keep the litter dry and allow more effective cleaning out of old litter between batches of chickens. Fresh litter should be used liberally, to a depth of six inches or more for chickens over 12 weeks old.

One effect of the litter is to disperse worm eggs and cysts of other parasitic forms such as coccidia. The litter should be stirred up regularly, weekly or fortnightly, to disperse worm eggs and coccidia.

Do not run batch after batch of chickens over the same litter or the same ground or a build-up in worm eggs and coccidia will occur. Use fresh litter between batches. The writer recalls losses in chickens only three weeks old run on damp ground which had been used continuously by batches of cockerel chickens without any spell. Post-mortem examination showed large infestations by very immature large roundworms.

Dropping pits in the fowl-houses used by older chickens are a useful aid in reducing ground contamination by worm eggs. They are seldom seen in Queensland but are a feature in some other States.

Feed a good quality mash to which is added (if adequate supplies of succulent green feed are not available) a vitamin A supplement by means of cod liver oil, fish oil emulsion or a stabilised vitamin powder.

SUMMARY.

Roundworms are sometimes prevalent in growing poultry stock in Queensland.

There are two types, the large roundworm or intestinal roundworm, and the small or caecal roundworm. The large roundworm is by far the more important of the two.

The large roundworm causes unthriftiness and anaemia in chickens. Roundworms act as a "stress factor" to other diseases. Adult fowls are relatively resistant but this resistance may be broken down by vitamin A deficiency.

The caecal roundworm aids the survival of the microscopic blackhead parasite which causes blackhead, a serious disease of turkey poults.

All chickens half-grown or more should be treated for roundworms if reared on the ground and confined in pens. Treatment is cheap and effective if given correctly. Worms passed out following treatment may be eaten by fowls, but this is of no importance.

Roundworm infestation can be reduced or even eliminated by certain husbandry methods.

Some Principles of Silage Making

By Officers of the Agriculture Branch.

Silage is a succulent and nutritious feed, containing almost as much moisture as a green crop. If well made it has more food value per acre than hay from the same crop.

It is the cheapest form of stored fodder, and there is less material lost in making silage than in making hay. Well-stored silage does not spoil during storage.

TEMPERATURE CONTROL AND ACID FORMATION.

The silage-making process is simple and easily controlled.

Actually, silage can be regarded as a pickled fodder, for acids are formed through the breakdown of the starch and sugar in the crop. When formed in sufficient quantity, they preserve the silage. These acids are similar to those normally present in the digestive tract of stock and are in themselves of food value.

The emphasis always given to tight packing and the exclusion of air from the crop when filling the silo is fully justified, as the following discussion shows.

The first important change in the stored fodder is the utilisation of all the oxygen in the trapped air by the still living plant cells. So long as there is air present, the living plant cells will breathe, and temperatures will rise. If air is still present after the plant cells die, moulds and yeasts will develop and cause spoilage.

Normally when the air is used up the plant cells die. Bacteria present at all times on the leaves and stems then start working on the cell sap, forming the acids which will preserve the crop.

There are numerous types of bacteria, some useful, some undesirable, present on plants. The question of which type dominates the fermentation process is determined by simple temperature control in the silo.

As the temperature is related to the amount of air trapped in the plant material, the desired temperature is achieved by controlling the amount of air present. The more pressing down the material gets, and the softer it is, the lower is the temperature developed. The ideal temperature for the formation of lactic acid, which makes the best silage, is approximately body temperature—that is, about 100 deg. F.

If the crop is too soft or the pressure too great, too much air is expelled and not enough heat will be developed. The result then will be bad smelling silage which is useless.

Each day's filling should reach 90 deg. F. before continuing with the filling process. Softer, higher-protein crops, such as improved pastures and lucerne, generally pack more tightly and thus heat more slowly than the more fibrous high-sugar crops such as maize and sorghum. Low temperatures must be carefully guarded against with high quality crops. The filling rate should be slower, and less pressure is needed. Controlled wilting of the crop assists in obtaining correct temperatures and a high quality product.

If the crop is mature, or coarse and stemmy, or left too long to wilt after cutting before placing in the silo, it

may not be possible to pack the crop sufficiently to drive the air out. High-temperature silage will result. This high-temperature silage is dark-brown in colour, sweet and palatable, but its food value is of a lower order. It is, nevertheless, a much more useful fodder than silage that has not reached the correct temperature.

Excessively high temperatures during manufacture lead to charring and spoilage. These high temperatures can be avoided either by fine chaffing, by greater pressing down, of by the addition of water or a molasses solution to soften the chaffed material and assist compaction.

Plate 1.

A Well-grown Maize Crop at the Right Stage for Cutting.

All these measures are designed to bring respiration of the plant tissues to a stop by excluding air. The molasses solution has no advantage at this stage over water, but when respiration has ceased, the fermentation of the molasses will speed the preservation, and reduce the amount of plant sugars used up in the process.

Temperatures are generally taken at about two feet below the surface.

Earlier failures in conserving high-protein crops such as young grass and lucerne have led to the development of modern methods which take the uncertainty out of the silage-making process.

HIGH-SUGAR CROPS WITH LOW PROTEIN.

Crops of this type (such as maize and sorghum) are cut at the "milky-grain" stage or later, when the proportion of starches and sugar to protein is high and when there is plenty of sugar for fermentation into lactic acid.

In air-tight silos, with good pressing down, temperatures may not rise above 100 deg. F. if the silage has been chopped to get close packing. Generally, however, heat development is speedy in crops of this type and so filling can be continuous. Temperature checks should never be neglected, especially in the first few feet at the bottom of the silo.

Where a high-sugar crop has not been chaffed, it is very difficult to avoid the temperature rising to 120 deg. F. or higher, and so the result is generally a dark-brown, sweet silage. It is possible to be misled by the obvious palatability of this silage into the belief that it is better than it really is, but it must be realised that high temperatures can cause a considerable loss in food value.

LOW-SUGAR CROPS WITH HIGH PROTEIN.

Young grass and crops with a high moisture and high protein content (such as lucerne and other legumes) do not heat readily and are also low in fermentable starches and sugars. Even when cut at a fairly mature stage (after flowering), the low sugar content makes it difficult to be sure of obtaining a first-class product.

Yet these high-protein, low-sugar crops are the most important silage crops, because if they are stored efficiently, they can provide a rich fodder for growth and production of stock as well as for maintenance.

As there is not enough sugar available in these crops to make acid quickly for effective preservation, molasses is added. This enables the development of sufficient lactic acid from the sugar in the molasses to prevent the action of undesirable bacteria. Usually two to three gallons of molasses dissolved in a similar volume of water is added to each ton of protein-rich plant material.

While this molasses provides the necessary extra sugar, it affects the process somewhat by adding unwanted extra moisture. The moisture content of the crop at the time of ensiling is regarded as the most important factor in controlling silage fermentation.

MOISTURE CONTENT OF ENSILED PLANT MATERIAL.

The best moisture content for silage making is 60-70 per cent. If the moisture content is below 60 per cent., the crop will not pack well and mould will develop unless the bulk is covered on top with wetter material. Above 70 per cent. moisture, the possibility of poor silage resulting through seepage increases unless the crop is pre-wilted to reduce the moisture content. Seepage represents a loss of acid and food nutrients.

In a high-protein crop, the loss of lactic acid by seepage makes conditions suitable for undesirable bacteria which cause unpleasant odours and sliminess.

Most forage crops have a moisture content of from 70 to 80 per cent. in their most nutritious stage (see Table 1).

The chance of obtaining high quality silage is always best with crops at a stage when dry matter is 25-30 per cent. and moisture 70-75 per cent. at cutting.

(*c*) An acid-forming preservative such as sodium metabisulphite may be used.

Wilting.

Wilting of high-moisture crops favours the production of a mild, palatable silage. It also reduces the loss of food that would follow any seepage from the pit if the crop were not wilted. The crop must not be wilted too much, and the driest material should always be placed at the bottom of the pit. The aim of wilting is to bring the crop down to a moisture content between 65 and 70 per cent.

When wilted to the correct stage, the stem and leaves will be limp. The material should feel cool and moist, but no free sap should appear if a handful of chopped crop is squeezed. The stems should be easily broken by twisting, and the broken ends should have a dark and moist appearance, but should not be very juicy.

TABLE 1.

Relation Between Stage of Growth and Dry Matter Content of Crops.

Crop.	Average Dry Matter Content.	Average Moisture Content.
	%	%
Maize—		
Tassel and silk stage	16	84
Early milk stage	18·6	81·4
Late milk stage	20·9	79·1
Dough and dent stage	25·8	74·2
Grain mature, husk green	32	68
Grain mature, husk brown, most stalk green	38·8	61·2
Lucerne—		
Before bloom	17·1	82·9
Early bloom	22·6	77·4
Full to late bloom	27·3	72·7
Late bloom to seed	33·4	66·6
Cereals and Grasses—		
Before heading	17·1	82·9
Headed to bloom	22·6	77·4
Early seed stage	27·3	72·7
Seed formed	33·4	66·6

Source.—Information abstracted from Ohio Agric. Exp. Stat. Res. Circ. 18. April 1953.

Adjusting High Moisture Content.

Three things can be done to adjust a high moisture content in silage material:

(*a*) The crop can be wilted in the paddock to a moisture content between 65 and 70 per cent.

(*b*) Dry preservatives such as chaffed hay and ground grain can be mixed with the chopped crop during filling.

The leaves should not become dry or curled. Provided the crop is not too heavy, wilting for one to two hours is adequate in fine weather. In humid weather, half a day to a day may be required to get sufficient wilting, while in hot, dry weather wilting may not be necessary.

It is usual either to chop or to bale wilted crops for silage. Trenches or stacks filled with a buckrake are generally filled without intentional wilting, unless the crop is excessively soft and moist. Sufficient wilting generally occurs between the time of cutting and collection by the buckrake. If too much crop is cut at any one time, it may not be possible to gather it quickly enough to prevent excessive wilting. In this case, excessive heating will occur and feed quality will be lost.

When chopping a wilted crop by forage harvester or stationary chopper, the length of cut is varied according to the amount of wilting that has occurred. The more wilted the plant the shorter the cut of the chopper.

Excessive wilting will make it more difficult to pack the crop and exclude air, and may result in moulding; hence the need to cut such material short to improve compaction.

Molasses solution added to this wilted material will speed up acid formation and assist in producing a higher quality silage.

Use of Dry Preservatives.

The most satisfactory method so far developed for ensuring the production of top quality attractive silage from high-moisture, high-protein material is through the addition of ground cereal grains. These have a dual action. They provide a considerable amount of fermentable starch and so assist in the rapid development of acid. They also lower the moisture content of the mass by absorbing surplus crop moisture.

If 150 lb. of ground grain of 12 per cent. moisture is added to a ton of chopped green crop of 75 per cent. moisture content, the moisture content of the mass will be reduced to about 70 per cent. Thus the ground grain acts not only as a preservative, increasing the speed of acid formation, but also as a conditioner, reducing the moisture content of the mass to safer limits.

Overseas research suggests that at least 80 per cent. of the feed value of the grain is retained in the silage mixture.

Use of Acid-forming Chemicals.

When research into the silage-making process revealed that a quantity of the sugary foodstuff in the crop was converted into lactic acid and other acids, a new line of study was opened.

If these acids acted as preservatives for the ensiled crop, then the addition of acid to the crop as it went into the silo should save some of the food being needlessly used up.

This line of research led many years ago to the development of the A.I.V. process of adding dilute sulphuric and hydrochloric acids.

Molasses, which consists of cane sugar and invert sugar with impurities, was found of value, especially with crops of low sugar content, as the molasses quickly changed to acid in the silo.

More recently, sulphur dioxide gas treatment was tested, and from this arose the present practice of adding a powdered chemical, sodium metabisulphite, in relatively small quantities —10 to 12 lb. per ton—to the chopped crop material as it is placed in the silo.

All previous methods of making silage depended on control of temperature rise to about 100 deg. F. so that mainly lactic acid would be formed.

With sodium metabisulphite, heat is very undesirable and filling and packing is carried out as quickly as possible to keep temperatures low. High temperatures destroy the usefulness of sodium metabisulphite.

Little local experience has been gained with this process yet, but it has been widely accepted overseas. There it is claimed to reduce the loss of food nutrients in the silage, to conserve more of the sugars and vitamins, and to improve the palatability and odour of the silage. A few workers, however, have claimed no beneficial results from the use of sodium metabisulphite.

PARTICULAR MOISTURE PROBLEMS.

Frosted crops should be made into silage immediately they are affected. It is generally advisable to add water to this material when making silage.

Droughted crops should be harvested before the leaves die completely. Water should be added when the crops are put into the silo.

Crops damaged by drought or frosts can be salvaged most effectively by making into silage.

Drainage is important. When crops have a high moisture content at the time of ensiling, there will be seepage of plant juices downward. This seepage must be carried away from the bottom of the silo or it will produce an unpalatable, sour and soggy mass. This seepage contains a considerable quantity of soluble food. The importance of correct treatment of the silage crop is therefore obvious.

Mouldy silage is undesirable. Mould throughout silage in an air-tight silo suggests that the crop was too dry when the silo was filled and that respiration and fermentation did not use up all the air.

Mould may develop in silage in pockets where packing was imperfect, even though the crop was cut at the correct stage.

Ensiling the crop at the correct moisture content of 65-70 per cent. combined with proper packing of the crop in the silo is the best method of preventing the development of mouldy silage.

In practice, feeding small amounts of mouldy silage does not appear to cause harm to stock, if given with other feeds, but it is not as palatable or nutritious as good quality silage.

Entry of rain water can be most destructive. The preserving acid may be leached out of the silage, and the product remaining made quite unfit for stock. To avoid this, the soil cover should be carefully checked from time to time for cracks and holes.

Length of Cut of Silage.

With unwilted crop material, the desirable length of cut varies both with the portion of the silo being filled and with the moisture content of the crop.

With immature crops high in moisture, the cutting length should be 1 in. or more for the crop material going into the bottom layers. This length of cut should be reduced to ¾ in. as the silo becomes half full, and to ½ in. when the silo is three-quarters full. As filling approaches completion, the cut should be reduced to ¼-⅜ in. to give the best possible surface compaction.

When crop moisture is about 75 per cent. or a little lower, the crop should be cut ½ in. long for the bottom fill and ¼ in. for the upper part. When the moisture is below 70 per cent., the whole crop should be chopped ¼ in. long. Fine cutting (¼ in.) is always desirable with wilted crops.

TESTS FOR MOISTURE IN ENSILED CROPS.

The moisture content of a crop when it goes into the silo is of great importance in determining the quality of the final product, so it is desirable to be able to test the moisture content on the farm.

One of the tests described below may be used.

Hand Squeeze Test.

With a finely chopped crop cut with a $\frac{1}{4}$ to $\frac{3}{8}$ in. setting, the squeeze test is fairly accurate.

A handful of the freshly chopped crop is squeezed between the hands for 20-30 seconds and then the pressure released suddenly. If the material retains its shape and has oozed sap on to the hands, the moisture is over

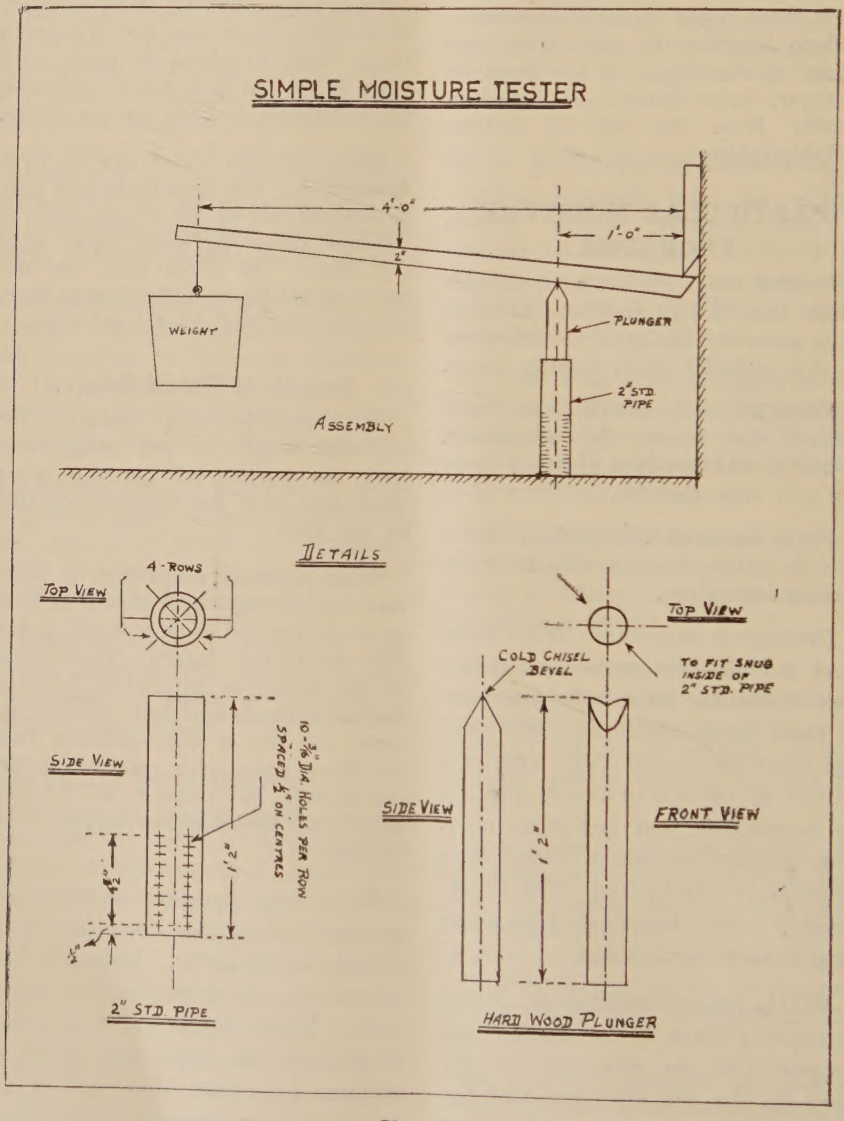


Plate 2.

Apparatus for the Mechanical Squeeze Test for Moisture in Ensiled Crops.

75 per cent. If it holds its shape but does not release any sap, the moisture is between 70 and 75 per cent. If it falls apart slowly, showing no free juice, the moisture is between 60 and 70 per cent., while if it falls to pieces immediately the hand is opened, the moisture is below 60 per cent.

Mechanical Squeeze Test.

Following is the list of the necessary equipment and a description of the procedure successfully applied overseas for determining approximately whether chopped crop material is moist enough but not too moist. The device is illustrated in Plate 2.

(1) A piece of 2-in. pipe, 12 in. long, open at each end. This pipe to have 4 rows, equally spaced, of $\frac{3}{16}$ in. holes $\frac{1}{2}$ in. apart on centre, 10 holes in each row starting $\frac{1}{2}$ in. from the bottom of the pipe. The burrs on the inside of the pipe made by drilling the holes should be smoothed off.

(2) A hardwood plunger 14 in. long, bevelled like a cold chisel on one end and flat on the other, and fitted to a snug but free fit to the inside of the pipe. Treat with linseed oil to make it impervious to moisture and to prevent swelling.

(3) A 4 x 2 lever, $4\frac{1}{2}$ ft. long. Use flatwise, with a bevelled end under a block nailed to a wall. Stand the testing pipe on a flat surface (wooden block or cement floor) near the wall so the top of the wooden plunger will fit in a small groove on the underside of the lever 1 ft. from the edge of the block on the wall.

(4) The material to be tested should be chopped with the silage cutter—not by hand. Set the cutter for $\frac{1}{4}$ in. lengths, if possible. Press the material firmly into the cylinder 6 in. deep, but do not tamp or press hard enough to squeeze out juice. Place under the lever and if the material is a legume, hang a 32 lb. weight on the lever 4 ft. from the wall block for 1 minute. If any seepage whatever occurs from any hole the moisture content is too high.

(5) To find out if the legume crop is getting too dry, hang a 64 lb. weight on the lever at the 4 ft. mark for 1 minute. If no juice exudes the material is drier than is most desirable. (In case a load has too much or too little moisture, run it into the silo anyhow, then try to have subsequent loads nearer to the desired content of moisture.

Crop*.	Length of Cut.	Weight required (at 4-ft. mark on lever) to express juice when the moisture content of the crop is—	
		About 68%†.	About 58%‡.
		Lb.	Lb.
Lucerne, soybeans and other legumes	¼-in.	32	64
	½-in.	41	Not determined
Small grains	¼-in.	50	82
	½-in.	66	Not determined
Grasses	¼-in.	60	90
	½-in.	79	Not determined

* For mixtures of these crops, use intermediate weights depending on the proportions of the different crops.

† If juice is expressed by the weights in this column the material is too wet.

‡ If juice is not expressed by the weights in this column the material is getting too dry.

(6) The pressure required to squeeze out juice varies with the kind of crop, the method of cutting, the length of cut, and the moisture content of the crop. The following table shows the weights to use under certain conditions, to determine whether the material is too wet or too dry.

Oil Distillation Test.

A simple farm method giving results that compare favourably with laboratory methods has been developed, using the oil distillation process.

The equipment required consists of an accurate dial spring scale weighing to 1,000 grams, a high-temperature thermometer reading to 200 deg. C. (392 deg. F.), a metal container of 1 quart capacity (with a lid, wire gauze removable liner and handle), and a supply of cooking oil such as peanut oil. The metal container and associated items can be purchased from most hardware firms and the thermometer can be obtained from drug houses and instrument-making firms.

The plant sample tested must be representative of the whole crop. Whole plants should be cut off at mower height and cut up quickly. When the crop has been mown and is sampled in the swath or windrow, a true cross-section should be taken, as some parts will be wetter than others.

To test the crop, 100 grams of crop chopped into 1-2 in. lengths is placed into 200 grams of oil in the wire gauze liner within the container. The total weight of the container, oil and crop is recorded. It is then heated on the stove till the temperature rises to 145 deg. C. (293 deg. F.). By this time, all the water has been driven off. The container and its contents are now cooled and reweighed. The loss of weight in grams of the container and its contents represent the percentage moisture content of the crop.

VITAMIN A FOR POULTRY.

A vitamin A supplement should always be fed to poultry, whether you are giving them green feed or not.

Tests have shown that green feed alone cannot be relied on as the sole source of vitamin A, even when it is young and succulent. For this reason, the addition of a vitamin A supplement to the mash is now a standard recommendation. Under dry seasonal conditions, when there is little or no green feed about, it is more important than ever to make sure that your poultry mashes contain a vitamin A supplement.

Agriculture Department trials have shown that fowls fed a vitamin A supplement in the mash in addition to green feed lay more eggs than those given mash with green feed as the sole source of vitamin A. On one farm, where one group of fowls were fed a poor source of green feed, the addition of a vitamin A supplement to the mash of another group also fed the same type of green feed increased production by 17 eggs per bird over a six-month test.

If you have succulent green feed and want to keep your feed bills as low as possible, use it at the rate of 5 lb. per 100 birds per day—but feed a quantity of vitamin A supplement in addition.